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Editorial Notes

Furnace Design

It is an interesting enquiry, to what extent furnaces are designed according to physical laws and to mathematical formulæ determined by engineering research, and to what extent they are proportioned by experience, by trial and error. When a gas engineer sets out to design a setting, does he apportion the area of the heating flues and passages, of the ports, and of the combustion chamber, from a knowledge of the flow of gases at high temperatures, from the physical laws governing the rate of heat exchange between the gases and the refractory material of which the retorts are composed? Or does he turn up the drawings of his last settings, and with recollection of the defects that developed in use, re-design his new ones in such a manner as experience suggests will best overcome those defects? It would be exceedingly interesting to read a book or an article written by a design engineer upon this subject of retort setting design. Whatever may be the practice in the Gas Industry—and we have our suspicions as to the procedure adopted—there can be little doubt that there has in the past been much of the trial and error principle in the design of most industrial furnaces.

Thus, Mr. A. D. Williams, writing only 15 years ago, pointed out that more or less mystery had enveloped the designing and construction of metallurgical furnaces; blueprints, with the titles removed, and tables of supposedly important features, were carefully treasured so that when new furnaces were to be designed, an extensive analysis of previous work was made in order to improve upon what had been done before. During construction, plants were visited and further "improvements" were frequently made, with the result that the finished furnace departed widely from the drawings. Not infrequently the starting up of a new furnace was signalized by an acrid meeting of the "lodge of sorrow" and by expensive reconstruction and loss of product. During the campaign of the furnace the question of what steps could be taken to change it was a very live issue, and when, as frequently happened, certain parts of the furnace had to be rebuilt, opportunity was afforded to correct early errors—provided they had been correctly diagnozed. Fortunately, the design of gas-making furnaces, of retort settings, has gone beyond the "lodge of sorrow" stage, and little or no difficulty occurs with the operation of retort settings to-day. Nevertheless there are differences in life of the settings, there are difficulties of operation due to corrosion and erosion of the brickwork, and there are certain major and minor differences as between one setting and another which suggest that improvement is even yet not outside the bounds of possibility, excellent as are modern settings.

These thoughts occurred to us following the presentation of a Paper on "The Principles of Design of Modern Industrial Furnaces" by Mr. C. Webb recently to the Institution of Chemical Engineers. Mr. Webb pointed out that during the past few years considerable developments have taken place in the design of industrial furnaces, which have resulted in reduced fuel consumptions, longer life of working parts and refractories, and more accurate control of heating schedules. In Mr. Webb's opinion, these improvements have been the result of careful study by furnace builders of the operating conditions required by manufacturers, and by the wider application of scientific principles to the design of furnaces. He added that by a study of the design and by careful selection of the materials to be used, results are obtainable to-day which show very great improvement on equipment in use a few years ago. Unfortunately, Mr. Webb gave no indication in his Paper of the methods by which design has been studied or of the principles that have emerged as the result of that study. That is a pity, and detracts from an otherwise excellent performance, because if so careful a study has been made of the factors in design that influence the operation of the furnace as to improve materially its life and performance, it is evident that much of value must have been learnt which should be placed on record. Mr. Webb seems to ignore the work of the British Refractory Materials Research Association which has done so much to improve the quality of refractories, and the practical work of the refractory manufacturers, which must have contributed in no small measure to the increased life of furnaces, and therefore to the improved working results. He gave little or no indication that the furnace designer bases his designs on a knowledge of the laws governing the flow of gases at high temperatures or of the physical laws of heat transmission as contained, for ex-

ample, in the work of Saunders and Fishenden. There is no doubt that the industrial gas departments of the larger gas undertakings have also played no small part in the general improvement that has occurred in furnace technique.

Why Not Town Gas?

THE Paper contained diagrammatic drawings of a triple fired continuous furnace for steel slabs, of a muffle type annealing furnace fired with town gas, of an 8-pot glass furnace, of a producer gas fired glass tank furnace, of a reheating furnace, and of a recuperator. Then followed an exposé of the method by which some of the furnace dimensions are calculated. The heat input required is calculated from known specific heat data and the dimensions of the heating surface are determined in accordance with entirely empirical rules, such, for example, as that iron or steel required for forging can be heated at the rate of 80 lb. per sq.ft. per hour, whereas for annealing the rate is 60 lb. per sq.ft. per hour. The survey of the fuels available is disappointing, as the Author hardly deems coal gas—except in the form of coke oven gas—as worthy of mention. He extolled the use of automatic coal stokers and remarked that "on a cost basis this fuel often proves the least expensive"; he referred to producer gas generated from coal in which the hot tar is carried forward into the furnace; and he referred to coke oven gas, to oil, and electricity—but of town gas there was no mention. Surely Mr. Webb, as a practical furnace designer, must know of the ever-growing number of instances in which coal gas furnaces are finding application in industrial heating, this being due not to considerations of first cost alone, but to the continuity of supply, ease of regulation, and certainty of control that become possible.

When heat is transmitted by radiation, the thickness and luminosity of the gas layer passing over the material play an important part, and the tendency in modern practice is to increase considerably the space over the material in order to derive the benefit from a large volume of comparatively slowly-moving gases radiating onto the material. Presumably this practice would only be followed with a luminous flame; if the flame were non-luminous, the heat would be preferentially radiated from the heated brickwork onto the material, and a thin layer of hot gases would be preferable. The velocity of combustion is shown to be highly dependent upon the mixing of the gas and air and of the degree of preheat. For example, with poor mixing of fuel with cold air the rate of heat release may be only 1·5 B.Th.U. per cu.ft. per second; with reasonably good mixing of fuel with preheated air, it may rise to 3 to 4 B.Th.U. per cu.ft. per second; with good mixing of fuel with preheated air, to 6-10 B.Th.U.; and with very fine atomization of fuel and perfect mixing with highly preheated air the rate may become 10 to 20 B.Th.U. per cu.ft. per second. For annealing and re-heating furnaces, where a soft heat is required, the rate of heat release appears in general to be some 3 to 4 B.Th.U. per sq.ft. per second, but for high-temperature work the increased rate of 10 to 20 B.Th.U. is not unusual.

The Paper, as the Author explained, dealt "in a somewhat elementary way" with a very interesting subject. The reader will find many things which he wants to know, but which are not answered. Why does the calculation of heat losses from the furnace take no account of convection, which is of considerable importance when the furnace walls are exposed to a current of air? On what principles are the several permissible gas velocities through the plant calculated? Why did the Author, when dealing with metal heating furnaces, pay no attention to the sulphur content of the gases used? It has been conclusively shown by Professor Cobb and his co-workers at Leeds that quite a moderate sulphur content in the heating gases considerably increases the losses of metal in re-heating furnaces. It has been shown in Papers before the Iron and Steel Institute (*e.g.*, by Bischof and Maurer) that the sulphur content of the steel from open-hearth furnaces is profoundly influenced by the sulphur content of the heating gases, since an equilibrium is set up between sulphur in steel and sulphur in furnace atmosphere. For these purposes it is not necessary completely to purify the gas from sulphur, and a total sulphur content of some 50 grains per 100 cu.ft. is as far as one needs to go. The superiority of purified coal gas as a fuel for the metallurgical furnaces is partly—but only partly—based upon these facts. The design of industrial furnaces is a fascinating subject for those who are able to pursue it. Perhaps in putting these questions regarding empiricism *versus* calculation, we may have had our tongue in our cheek a little, for is it not written in the preface to Professor Trinks's book on the subject (1934): "Since (and probably because of) the appearance of former editions of this book, the building and operation of industrial furnaces have become less of an art and more of a science."

Flame Temperature Measurement

THE determination of flame temperatures is a problem of considerable importance industrially but, as evidenced by the Papers read on this subject at the recent Institute of Fuel Symposium on Gas Temperature Measurement, presents problems of considerable complexity. The temperature of a flame is in itself not a clearly defined entity. A flame, in the broadest sense of the word, is the total region within which the chemical reactions take place, converting the gaseous mass to the final composition which it will have at the temperature of the surrounding atmosphere. A complex gaseous mass is brought to a high temperature as the result of chemical reactions of considerable, and partly unknown, complexity. As the gas cools slightly other reactions, including re-association of dissociated molecules, take place which liberate further heat. The gaseous constituents of the products of reaction radiate heat, carbon dioxide and water vapour being the prime radiators. In many flames there exist small solid particles of carbon liberated by the primary decomposition and partial combustion of hydrocarbons; these particles, by their combustion, add to the flame temperature, but by reason of their high radiating power also cause the flame to lose heat. Amid all this crucible of chemical reaction, what and where is the flame temperature?

There is, moreover, a further complication according to the manner in which the gas is burned. Thus in industrial furnaces, in which the air comes into contact with the combustion gas over a long distance, measurements may be made at various points several feet apart. In laboratory researches the object is generally to determine the maximum temperature reached in the heart of a flame produced by a mixture of known composition. This maximum is found in the region above the blue cone, and corresponds to the temperature calculated when the amount of heat given out by the reaction and the composition of the gaseous product are known. After attaining this maximum the temperature decreases as a result of radiation losses, mainly in the infra-red

bands of water vapour and carbon dioxide. This cooling effect is offset at first by recombination of the various groups or atoms set free at the moment of initial combustion. In industrial practice we do not necessarily wish to know only the temperature of the hottest spot.

Having decided in what part of the area covered by the chemical reaction the temperature is to be measured, the two primary methods available are based on (1) heat exchange between the flame and a solid body—*e.g.*, a thermocouple, and (2) radiation from the flame. The first of these methods involves considerable difficulties and is not generally suitable for flames higher in temperature than 1,800° C. Most of the methods that can be used are based on the principles already described when we discussed those Papers which dealt with gas temperature measurement ("JOURNAL" for Dec. 7, 1938). The errors result from radiation of heat from or to the measuring instrument. They can be corrected by using three thermocouples and extrapolating to a theoretical couple of zero diameter. A form of suction pyrometer can also be used for temperatures up to 1,000° C. in which the thermocouple is surrounded by sheaths heated in the flame, to minimize loss of heat by radiation, the hot gases being aspirated over the couple at velocities of the order of 100 metres per second to increase the convectional transfer of heat from gas to thermocouple. By using a tube of zirconia instead of a thermocouple in this apparatus, an optical pyrometer being sighted on the tube, it is possible to measure flame temperatures up to perhaps 1,800° C. In another method the surrounding sheath is electrically heated.

N.P.L. Method

THE National Physical Laboratory uses a method in which a resistance wire is first heated electrically in vacuo, its temperature being measured for various currents; this operation is repeated with the wire in the flame. The new curve cuts the old at a point which represents an identical thermal equilibrium, the wire losing energy only by external radiation as during its calibration. The equilibrium is, therefore, independent of the flame, which is possible only when the two temperatures are equal; hence this temperature may be read immediately from the graph. This method presupposes that the radiation of a wire at a given temperature is the same in vacuo as in the flame. It also involves an exact knowledge of the monochromatic emissivity of platinum, in order that the true temperature may be derived from the brightness temperature. All these methods have a restricted field of application on account of the changeability of platinum and its alloys at relatively low temperatures. At about 1,600° C. the characteristics of platinum wires are no longer sufficiently stable over a period. Platinum/platinum-rhodium couples should be used at temperatures below 1,500°, because of changes resultant upon the slow distillation of rhodium.

The practical problem of determining the temperature of a flame within a furnace was not discussed at this meeting, and the otherwise excellent Paper of G. Ribaud, Y. Laure, and H. Gaudry did not give a definite lead on that industrially interesting phase of the subject. In general the walls of the furnace surrounding the flame will be hot, but at a somewhat lower temperature than that of the flame itself. Care is often taken industrially to spread the flame over a large volume (or long length of travel) to avoid local cutting flames which would fuse the refractory. Where the flame is sufficiently dense to possess an axial zone, within which the gas radiation is diminished by the screening effect of the rest of the flame, the suction pyrometer method or that of extrapolation to zero thermocouple diameter may give good results if the temperature is not too high to admit of the method being used.

Special arrangements would be necessary to admit of the industrial use of the radiation methods employed by physicists for determining the temperature of luminous flames. These methods for the most part appear to be modifications and refinements of Kurlbaum's method. Briefly, and non-mathematically, in this method an image from an auxiliary high-temperature source, which may be an electric arc or a tungsten filament lamp, is brought by a lens to a focus within the flame at the point where the temperature is to be measured and is observed by means of a monochromatic optical pyrometer provided with a filter transmitting only the particular wave-length selected. The temperature of the auxiliary source is adjusted by trial and error until the interposition of the flame causes no changes in the pyrometer setting. It is not necessary to know the true temperature of the auxiliary source, but only the brightness temperature of its image in the flame, a temperature obtained direct by pyrometer measurement. Since all the methods for the optical determination of the temperature of luminous flames appear to involve the formation of an image within the flame, they would not seem to be applicable to practical furnace conditions, but for use in the laboratory only.

Non-Luminous Flames

DETERMINATION of the temperature of non-luminous flames depends on Féry's method, which since its publication in 1903 has been modified and extended just as has Kurlbaum's method. This method is based on the phenomenon of the inversion of the spectral lines of a metallic vapour introduced into the flame. As in Kurlbaum's method, an auxiliary high-temperature source is focused onto the flame. The image, with the image of the flame, is then projected onto the slit of a spectroscope. The transparent flame is coloured by a salt emitting a given wave-length, which is observed in the spectroscope. Where the auxiliary source has a low intensity, the wave-length emitted by the flame stands out against the darker continuous background given by the source. As the brightness of the source is increased, the line disappears and then re-appears as a dark line against a bright background. The temperature of the auxiliary source at reversal, which may be taken by a pyrometer, gives the temperature of the flame. Certain corrections and refinements of technique are necessary, but this is sufficient to indicate the method.

An interesting method that might well be applicable even to industrial conditions consists in taking a sample of the gases immediately after combustion by means of a water-cooled tube. Knowing the heat of reaction, gas composition, and dissociation constants it is possible to determine theoretically the temperature reached if the specific heats are known with certainty. Properly speaking this is a method not of measurement but of calculation. At the time when the method was put forward (1909), specific heats were not known with any certainty, and it is only within the last few years that sufficiently accurate data have been available for such calculation to be satisfactory. It can now be carried out fairly readily for mixtures of combustible gases and air. Actually this method is subject to certain objections; molecules dissociable at high temperatures and whose dissociation products are unstable at ordinary temperatures cannot be sampled in the state in which they exist in the flame. This

may viviate calculations based on the composition determined by chemical analysis particularly where atomic hydrogen is formed in the centre of very hot flames.

The Authors of the Paper quoted have no doubt that the method of spectroscopic inversion of the sodium line is most likely to lead to reliable results provided proper precautions are taken, but they state that in considering the extensive bibliography on the measurement of flame temperatures few measurements appear to have been carried out with due regard to all these conditions, particularly the control of initial temperature and humidity. The majority of the results published by German authors have been obtained by methods using metallic wires. Measurements based on Féry's method have too often been carried out by colouring the entire flame, which explains the fact that most of the results tend to be low.

A New Year's Resolution

There is no doubt that the success of the efforts towards clarifying the problem of unaccounted-for gas depends in the first place on the attainment of a uniform method of expressing the term "unaccounted-for." Hence the desirability of the general adoption of the agreed form of calculation submitted by the Sub-Committee on Unaccounted-for Gas in its interim report at the Research Meeting of the Institution last November. It is to be hoped that all gas undertakings will adopt the new system, and the beginning of the new year is a suitable time. The necessary arrangements for recording the gas made in accordance with the correction recommended and the temperature and barometer figures could most conveniently be made from the beginning of the year.

"JOURNAL" Calendar and Directory, 1939

The majority of our subscribers should by now be in possession of the new edition of our yearbook, in which there have been no marked alterations to an arrangement which has proved universally popular. One or two features, however, call for comment.

"Monthly Statements of Manufacturing Results" were introduced last year as an experiment; and later in the year we addressed a questionnaire to a number of representative medium-sized works to enable us to gauge the utility of the section. The replies showed that the pages were actually used in a great many cases, and in others had served as a useful guide for an undertaking's own record books. We have therefore retained the section, but have reset the headings in tabular form with a blank page for notes facing each month's figures. Columns have been left for the previous year's comparative figures.

In the Directory, Part I.A, can be traced the further progress of the Industry in consolidation and price rationalization, and numerous further acquisitions and amalgamations are evident in the records of the Holding Companies, Part II. The United Kingdom Corporation has expanded most, having acquired no fewer than 9 undertakings with an aggregate make of over 750 millions per annum. Completion of the transfer of Ellesmere Port is due for April 1 next, and other negotiations are being carried on. In Part VI. much new useful information has been incorporated, including references to the Coke Associations and the World Power Conference.

The "JOURNAL" "Handbook," which follows the Directory, contains numerous additions to the mass of useful data compiled by Colonel W. M. Carr. The new matter includes information on gum formation, A.T.B. control, formulæ for measurement of flow of gases by Venturi meters, &c., and a section on automatic control of central heating installations. The Institution specifications for wrought-iron pipes and for refractories are summarized. At the end of the "Handbook," H. T. Seymour has considerably extended his explanatory notes on income-tax, rating, and valuation, and the "Gas Engineer's Bookshelf" has been brought right up to date by T. A. Tomlinson.

Finally, we commend for the study of our subscribers the advertisement section, which provides a very attractive and very wide-angled picture of what the "other side" of the Industry can do for the gas manufacturer.

Personal

Mr. G. F. JENKINS, who has previously been connected with the special water heating department of R. & A. Main, Ltd., took over his new appointment as Sales Manager of the associated Company, Main Water Heaters, Ltd., on Jan. 1.

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A reminder of the passage of time comes afresh from the intimation of changes in the Constitution of the Board of Directors of Alder & Mackay, Ltd. Mr. WILLIAM GRANT has expressed his desire to be relieved of part of his duties; his resignation as Joint Managing Director has been accepted as from the end of the year. He retains his seat on the Board and will continue to act as Secretary. The Directors have appointed Mr. STANLEY BENNET and Mr. J. O. SCOTT as Joint Managing Directors in Edinburgh; Mr. H. E. BENNET has been appointed Deputy-Chairman, and Mr. ALASTAIR M. GRANT, son of Mr. William Grant and grandson of the late Mr. Alexander Mackay, has joined the Board.

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Mr. A. P. SCARTH, of the Alliance and Dublin Consumers' Gas Company, has been appointed Deputy Sales and Fittings Superintendent to the Sheffield and District Gas Company, and takes up his new duties on Feb. 1.

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In the New Year Honours List is the name of Sir F. E. SMITH, K.C.B., C.B.E., who has been awarded the G.B.E. Mr. J. B. F. WATSON, Director of the National Confederation of Employers' Organizations, has been created a Knight.

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On Dec. 28 Mr. H. G. BROADBRIDGE was presented with a hall-robe by the members of the Leamington Priors Gas Company's staff on his resigning to take up the position of Engineer and General Manager to the Andover Lighting and Power Company. On behalf of the staff the presentation was made by Mr. R. S. Ramsden (Director, General Manager, and Engineer), who said that during the period—over 21 years—Mr. Broadbridge had been connected with the Company the pleasant relations he had held with the other members of the staff and all the employees had been specially noteworthy. Among the essentials leading to success in such matters was appreciation of the other man's point of view, and he knew that Mr. Broadbridge had not been wanting in this. On behalf of his colleagues he expressed the hope that similar happy conditions would continue in Mr. Broadbridge's new surroundings.

Mr. F. A. Jenkins (Sub-Manager and Assistant Engineer) said that he was speaking for the whole of the staff in congratulating Mr. Broadbridge on his well-deserved success, but at the same time he regretted that such a popular and efficient colleague was leaving. He wished Mr. Broadbridge every success in his new appointment.

Mr. Broadbridge, in thanking Mr. Ramsden and the staff, said that the time he had been with the Leamington Priors Gas Company had been a very happy one, and that he had no intention of forgetting his old friends. Andover was not so very far away, and he hoped to be able to renew his friendship with them from time to time.

Mr. Broadbridge was also the recipient of an engraved cigarette case and lighter from the retort house employees.

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Having reached the age limit fixed by the Local Government Superannuation Act, 1937, Mr. J. GIBSON, Gas and Water Engineer to the Mansfield Corporation, will retire at the end of April. He was appointed in 1916.

Obituary

The death has occurred of Mr. JOSEPH JAMES GITTINGS, Governing Director of Messrs. Gittings & Hills, Ltd., paint and varnish manufacturers of Tower Works, Nechells, Birmingham. During Mr. Gittings' long and active business career (he was associated with the paint trade for almost 60 years) he had made a host of friends throughout the trade and among customers of the firm.

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Mr. T. GIBBONS FROST, J.P., a Director of the Chester United Gas Company, and three times Mayor of Chester, has died at the age of seventy-eight. He was a member of Cheshire County Council for more than thirty years.

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We regret to announce the death on Dec. 31 last of Mr. WORTHINGTON CHURCH at his home at Felixstowe in his eighty-sixth year. Mr. Church was, at one time, well-known in the Eastern Counties as proprietor of several gas undertakings, among which were Southminster, Kelvedon, Coggeshall, Wickham Market, Swaffham, Fakenham, Watton, Rayleigh, and Billericay. He was formerly a Director of the Grays and Tilbury, Thetford, and Felixstowe Gas Companies. He founded the firm of the Midland Coal and Cannel Company, from which he retired a few years ago, in 1886.

Institution of Gas Engineers

Members of The Institution of Gas Engineers will be welcome at the undermentioned Meetings:

The Institution of Electrical Engineers to be held in the Lecture Theatre of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C. 2, on Jan. 5 at 6 p.m. A Paper will be read by Mr. J. I. Bernard, B.Sc.Tech., on "The Application of Electric Heating to Domestic Hot Water Supply Systems."

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The Institution of Engineers-in-Charge to be held at the St. Bride Institute Bride Lane, Fleet Street, E.C. 4, on Jan. 11, at 7.30 p.m. A Paper will be read by Mr. H. L. Pirie, M.E., M.I.Mech.E., on "Selection and Purchase of Fuel for Steam Raising Purposes."

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The Illuminating Engineering Society to be held, by kind permission of Gaumont-British Picture Corporation, Ltd., at Film House, Wardour Street, W. 1, on Jan. 10, at 6.30 for 7 p.m. A Paper (with demonstrations) will be read by Mr. E. Stroud and Mr. H. C. Weston on "The Lighting of Cinema Auditoriums for Visibility and Safety" and will be followed by a discussion. Tickets can be obtained from the Secretary of The Institution of Gas Engineers.

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The Institution of Mechanical Engineers to be held at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W. 1, on Jan. 13, at 6.30 p.m. Mr. G. Stevenson Taylor, O.B.E., M.I.Mech.E. (H.M. Deputy Chief Inspector of Factories), will discuss the Safety Provisions of the New Factory Act and will reply to questions which have been prepared for him. Tickets can be obtained from the Secretary of the Institution of Mechanical Engineers.

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The Illuminating Engineering Society to be held in the Lecture Theatre of the Institution of Mechanical Engineers on Jan. 17 at 6.30 for 7 p.m., when there will be a Discussion on the Fourth Report of the Departmental Committee on Lighting in Factories. The viewpoints of the originators of the Report, the lighting expert, the factory manager, and the administrator, will be given, after which the subject will be thrown open for general discussion. Tickets can be obtained from the Secretary of The Institution of Gas Engineers.

Members of The Institution of Gas Engineers are informed that the Comité Consultatif International Téléphonique (C.C.I.F.) have prepared a publication entitled "Recommendations of the C.C.I.F. regarding the measures to be taken for the protection of cables against electrolytic corrosion. Edition of Rome, 1937. Revised text of Oslo 1938." Copies of this publication can be obtained from the Secretary, The Institution of Gas Engineers, at a cost of 8d. post free.

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Copies of the recently issued British Standard Specification for Horizontal Retorts and Intermittent Vertical Chambers (No. 819-1938) may also be obtained, price 3s. 6d. each, from the Secretary.

The "JOURNAL" Calendar and Directory

The undernoted changes in the "JOURNAL" Directory were notified too late for inclusion in the 1939 Edition, which should now be in the hands of our readers. It is proposed to continue our practice of publishing in the first issue of the "JOURNAL" each month a list of the various changes of which we are advised in order that readers may keep the particulars contained in the Directory up-to-date.

Page 10. BRIDPORT. J. L. Mayes, E., M., & S.
„ 24. EGREMONT. Capital, £4,925.
„ 46. MARPLE. Negotiating for sale to U.K. Gas Corporation.
„ 52. PADSTOW. W. J. King, S., resigned.
„ 68. TENBURY WELLS. J. H. Paterson, G.M. & E., resigned.
„ 70. TRURO. W. J. King, S., resigned.
„ 76. WHALEY BRIDGE. Price 14d. and sliding scales.
„ 82. COMRIE. Delete S. Macpherson, S.
„ 90. LOCHMABEN. W. M. Downie, E. & M., vice J. K. Simmons.
„ 92. PENICUIK. A. Mitchell appointed E. & M., vice A. Sneddon.
„ 139. SHANGHAI. Make, 827 mill.; consumers, 10,920.

Letter to the Editor

"Employee Salesmen"

SIR,—At a time when consideration is being given to what can be done during this year to increase the consumption of gas, may I, as one who has been on the production side and is still interested as a consumer, make a suggestion which, although perhaps not novel, has not in my opinion been sufficiently exploited?

From statistics I gather there are roughly 126,000 people at present directly employed in the Gas Industry, and each and every one of these could be made a potential salesman for its products, with their homes as model showrooms.

To this end each employee should be given his appliances at the cheapest possible rates, while he should be put on a two-part tariff basis of charge for gas appropriate to the size and class of his home. If the rates were properly fixed, such an arrangement should not only be an economic one for the employee, but of financial advantage to the gas undertaking concerned.

It might be that in some cases an all-gas house would be out of the question on the score of cost, and here a gas-cum-coke house could be substituted, with a special contract rate for coke.

Now in such circumstances each of these gas or gas-cum-coke consumers would be a satisfied user, and their friends would be told by them how economical was their arrangement with the gas undertaking, and the suggestion made that they, too, if they so wished, could obtain identical special terms for gas and coke, with particularly long deferred terms of payment for new apparatus.

In addition to gas undertakings' own employees, there are innumerable people employed indirectly in the Gas Industry who would, I am sure, be only too pleased to join in such a scheme.

It will be seen that the increased consumption which would be obtained by these means would be of the ideal type—namely, that per consumer.

It might take twelve months for the gas undertaking to experiment with its various employees to enable economical rates for the various types of houses to be arrived at, and during this intervening period, of course, the employees would not push the scheme. As soon as the rates were fixed, however, I see no reason why the "employee salesman," with his own "showroom," should not be the means of giving considerable impetus to the sale of gas for all purposes.

Yours, &c.,
"PER CONSUMER."

Jan. 2, 1939.

Women's Gas Council

Miss Halpin to Assist Work on Evacuation

The Gas Industry have agreed to second Miss Halpin (Organizing Secretary of the Women's Gas Council) for a period of three months to organize the work on Evacuation in which the Government has asked the Women's Voluntary Services to assist.

The Industry and the Women's Gas Council in particular, while reluctant to spare Miss Halpin, are yet conscious that it is an honour that she should have been asked, and feel that, by sparing her to do this important piece of work, they are contributing something in the cause of National Service.

The Women's Voluntary Service is an organization under the Chairmanship of the Dowager Marchioness of Reading which was created last May by the Home Secretary in order to obtain the more active support of women in connexion with A.R.P. Its work has now been extended to include Civilian Defence generally, and the W.V.S. has on its Advisory Council representatives from nearly every women's organization in the country. By this means the views and advice of women are being sought by the Government, and the W.V.S. forms the link between the various women's organizations and the Home Office who deal with A.R.P., the Ministry of Health who are responsible for Evacuation, and the Ministry of Labour under whom National Service will now come.

Special Courses in the Department of Coal Gas and Fuel Industries with Metallurgy have been arranged by the University of Leeds. A series of six lectures on the "Preparation of Coal for the Market" will be given by Mr. J. Crossland, M.Sc., M.I.Min.E. "Domestic Fuel" will be the subject of two lectures by Mr. H. J. Hodsman, M.B.E., M.Sc., F.I.C. Mr. C. A. Masterman, M.A., F.I.C., M.I.Mech.E., Mr. R. N. LeFevre, A.I.Mech.E., and Dr. C. M. Walter will give two lectures each on "Distribution and Utilization of Gas." Eight lectures will be given by Mr. G. J. Greenfield, M.Sc., A.R.C.S., A.M.I.Chem.E., on "By-Product Coking Processes" (including the utilization of coke oven gas for public supply). Mr. A. L. Roberts, Ph.D., will deal with "Recent Advances in Refractory Materials" in four lectures, while Mr. A. Preece, M.Sc., will give two lectures on "Engineering Metallurgy." Full particulars will be found in our advertisement columns this week.

News of the Week

Mansfield Gas Committee has instructed the Borough Surveyor to prepare plans and estimate of the cost of building new offices, stores, and workshops.

The Abolition of Dover Coal Dues is the object of a Bill, for the introduction of which leave is sought from Parliament by the Dover Gas Company and others.

So that Members of Kendal Rugby Club can practise at night, part of their ground has been floodlighted by gas, and the experiment has been voted a huge success by players.

With the Object of Converting Premises in High Street, formerly used by the Town Clerk, into a showroom, Bridgnorth (Salop) Council is to apply for a Provisional Order extending their powers under the Gas Order of 1881.

Application for a Special Order, under the Gas Undertakings Acts, 1920 to 1934, is intended to be made to the Board of Trade by the Knottingley Gas Company with the object *inter alia* of acquiring land for the storage of gas.

Devon County Council Invites Tenders for supplies during the twelve months ending March 31, 1940, of coke, refined tar, &c. Tenders on forms obtainable from the Clerk or the County Surveyors have to reach the former at the Castle, Exeter, not later than noon on Wednesday, Jan. 18.

Concerning the Installation of Cooking Equipment at the new open-air school at Blackamoor, the Blackburn Gas Engineer and Manager (Mr. J. D. Ashworth) submitted a report to his Committee. It was decided to ask the Education Committee to explain why the Gas Department was not invited to tender for certain domestic equipment being provided at the school, electrical apparatus having been selected.

Weekly Cookery Demonstrations are being held by the East Wight Gas Company in Sandown, Shanklin, and Ventnor, three towns in its area of supply. The present series has run since November, last year, and will be continued until the end of April. The Company has engaged as demonstrator Mrs. Stewart-Lunn, M.C.A., and finds the demonstrations attract good attendances and arouse considerable interest.

The Testing has been Completed on the Moscow streets, states the "Russia To-day" Press Service, of a new gas-generator motorbus, the first of its kind in the U.S.S.R. The bus has made runs aggregating 435 miles, during the last of which it developed a speed of 36 miles an hour. The gas-generator motorbus was built of standard parts of the "ZIS" motorbuses produced by the Stalin Automobile Works in Moscow. The gas-generator is placed in a cabin behind the driver's seat, but is separated from the passenger seats. Sufficient small wooden blocks are carried for a run of 68 miles.

We Have Received from the publishers a copy of the *Ironmonger* Hardware Buyers' Guide and Diary for 1939. As in previous years this useful publication contains many articles of topical interest and a host of valuable information. In the buyers' guide section, special features include articles on forming a company, railway rates, motor vehicle regulations, export credits, and trade education. Tables are given for domestic engineering, independent boilers, pipe sizes, central heating, warming by low-pressure steam, quantities for hot water pipes, and many other essential aspects of the hardware dealer's work.

New Plant Has Become Necessary at the Works of the Tipton Gas Department owing to the continued growth of the Undertaking. Apart from plant now required, a new installation of welded steel purifiers is nearing completion, and it is expected that in the near future an extension to the retort house will have to be made. Indicative of the growth of the Undertaking are the following statistics: In 1910, 4,750 consumers were supplied with 130 million cu.ft. The figures had risen to 5,380 and 180 million in 1920, to 7,050 and 228 million in 1930, and to 8,900 and 360 million (estimated) in 1938. The make of gas for 1938-39, states Mr. W. Williams, Engineer and Manager, will be 50% greater than it was in 1932-33.

A New Gasholder for Dalmarnock Gas-Works, at a cost of £24,645, was approved on Dec. 22 by the Glasgow Corporation.

In Our Review of 1938 we stated in the section dealing with Amalgamation and Grouping, p. 953, that the Tottenham and District Gas Company acquired the St. Margaret's Gas Company. Mr. E. J. K. Fussell, F.C.I.S., Secretary of the Tottenham Company, kindly draws our attention to the fact that Tottenham have acquired the shares of the St. Margaret's Company. Mr. Fussell also states that the effective date of the amalgamation of his Company with the Southgate and District Gas Company, to which we referred in our review of 1937, was July 1, 1938. It is regretted that this information was not to hand for inclusion in our article. Also in the section dealing with Tar Products, the words "coke-burning," line 2, second column, p. 963, should read "coke-forming."

A Reduction to Prepayment Consumers in the price of gas is to be made at Rhyl, where the Council has decided that as from April 1, 1939, the price will be reduced by 2d. per 1,000 cu.ft. Mr. T. Caradoc Williams, Vice-Chairman of the Council, opposed the proposal. He said the price of gas in Rhyl was as low as it was in many bigger towns. The capital cost of the Gas Undertaking was not borne merely by gas consumers. The town as a whole had helped to pay for it, and if the Council had something to give away, it should give it to the ratepayers as a body, and not to one section. Mr. J. Thornley, Chairman of the Gas Committee, said that 75% of the consumers paid for their gas through slot meters, and the Committee felt that it was they who had made the Gas Department pay.

The Heating Apparatus Broke Down at a Bridgwater church, the furnace coil developing a serious leak. It was found impossible to weld the leak, and the church was faced with an expenditure of some £60 to £70 for the renewal of the coil. The matter was urgent for the church authorities decided it was essential to hold services in the church instead of an adjoining hall and that heating was essential for the preservation of the organ, upon which £100 had recently been expended. They decided to remove the out-of-date installation and fit gas-steam radiators. The work, carried out by the Bridgwater Gas-Light Company, proved its efficiency on the following Sunday. With an outside temperature below freezing-point, the church thermometer registered 52°. The installation comprizes two four-columned, four six-columned, and one eight-columned radiators in the church, one four-columned radiator in the Minister's Vestry, and a gas fire in a small classroom adjoining.

A Campaign to Educate the Youth of this Country in the efficient and economical use of gas in the home has been launched by the combined sales organizations of the gas undertakings under the control of the United Kingdom Gas Corporation, Ltd. The campaign aims at making Britain's future householders aware of the unequalled efficiency of gas for all purposes and impressing them with the national importance of using it wherever possible, instead of imported fuel supplies, not only in the home but for industry as well. To achieve this the Corporation and its component companies have planned a far-reaching programme of educative propaganda. To capture the interest of young people while still at school, a Junior Cookery Club has been established with branches throughout West Lancashire and Cheshire. At these club centres girls from elementary schools are instructed in domestic science by experts. The sponsors have the full approval of the educational authorities. Clubs have already been organized at eleven centres: Leyland, Prescot, Ormskirk, Maghull, Runcorn, Hyde, Romiley, Northwich, Denton, Dukinfield, Frodsham, and Helsby. These are to be widely extended in the next few months throughout West Yorkshire, where, as announced last week, work has already begun on the initial stage of the Corporation's Gas Grid. The children are responding enthusiastically to their instruction, and their keenness is encouraged by cookery competitions, in which one finalist is chosen from each school in the district. Marks are given not only for the cooking itself, but also for work planning, personal appearance, serving and washing up, and cleaning of gas cookers and other appliances.

Need for Greater Benzole Production

Part Gas Undertakings Can Play

"The year 1939 will see a far greater public interest in all industries of importance to National defence," said Mr. Albert Hittinger, Managing Director of the National Benzole Company, Ltd., in an optimistic New Year message.

"I believe," he said, "that the realization of the necessity for the country to be fully protected has brought home to the general public the true importance of home industries. Great progress was made in 1938, and still better times are ahead, for in the coming year owing to the keener interest being taken in the purchase of home products, many industries vital to the country will be in a position to achieve further progress.

"Speaking for the British Benzole Industry, I am very hopeful of a favourable response by potential producers, particularly gas undertakings, to the call for increased supplies of home-produced motor spirit. The last year has seen many gas-works joining the ranks of benzole producers, but there is still room for considerable development in the production of benzole at gas-works. There seems, however, to be every sign that the non-benzole producing gas undertakings are becoming increasingly alive to the service they can render both to themselves and the Nation in developing this side of their business."

Gas to the Rescue at St. Margaret's Bay

It was stated in some of the London papers that the gas supply failed at the St. Margaret's Bay Hotel during Christmas, but what actually occurred was that an oil-fired water and central heating boiler failed at the Bay Hotel, and, as a consequence, the service in washing up was in such a chaotic state that the Hotel telephoned the Dover Gas Company. Foremen Young and Fitter Hogben, whose determined efforts in face of most disagreeable conditions are specially commended by Mr. G. le B. Diamond, General Manager of the Dover Company, left Dover on Christmas Eve to put matters right. They attempted to go by road, and were out nearly all night, but could not reach St. Margaret's Bay.

On Christmas morning another attempt was made by road without success. Finally, on Boxing Day, a motor boat was obtained and the men reached the Hotel by sea, and fitted a gas copper to provide some hot water. The motor boat went back to Dover with holiday makers returning home, and the two Gas Company employees gave up their seats in the boat. To get back to Dover the men had to plough their way through the snow to Martin Mill Station, where they arrived soaked to the skin.

Re-Building Scheme at Plymouth

Ministry of Health Enquiry

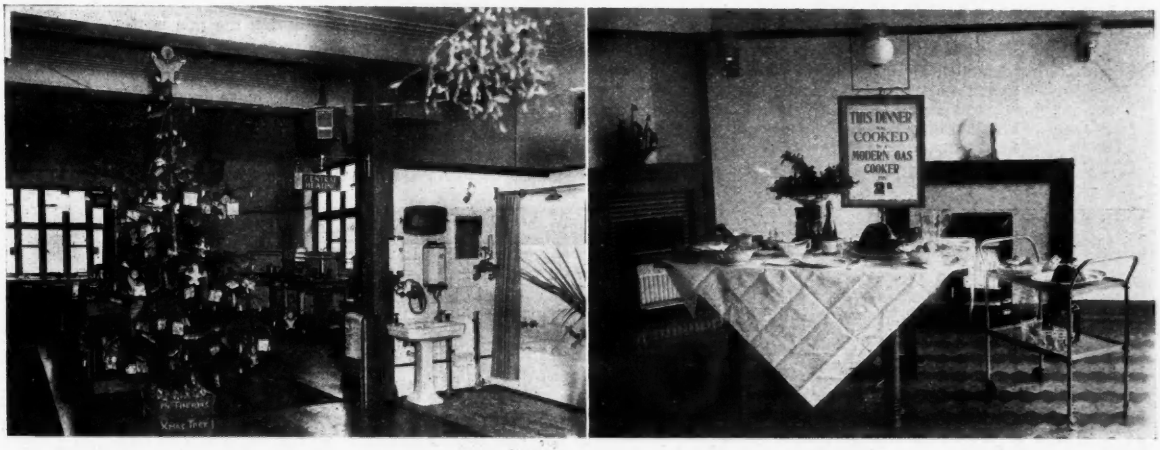
An enquiry was held at Plymouth by a Ministry of Health Inspector, Mr. G. H. Pritchard, on Dec. 20, into an application by the Corporation for consent to the borrowing of £28,000 for the provision of new and improved offices, A.R.P. shelter, and stores accommodation at the Corporation Gas-Works at Keyham, Devonport.

Mr. J. F. Knape, who represented the Town Clerk, claimed that the gas supplied by the Corporation was the cheapest in the West of England, which showed that the Undertaking was worked on a businesslike basis. The scheme for re-building the offices and storerooms had been under consideration for about three years by the Council, which had decided that the time was now opportune for the work. The premises dated back to about 1840, and were now totally inadequate for the demands made upon them. That referred to office as well as stores accommodation, and there was no suitable facilities for the men in the way of mess-rooms, lavatories, and showers. The new building would comprise five floors; in the basement an A.R.P. shelter would be provided, showrooms and packing-rooms on the lower ground floor, general offices and mess-rooms on the ground floor, demonstration-rooms, offices, and committee-room on the first floor, and stores on the second and third floors.

The Engineer and Manager, Mr. F. Blackburn, submitted details regarding the proposed new premises, and said the number of men employed was two hundred and fifty, of whom one hundred and fifty were actually in the works, while fifty of the hundred outside came in during the day. The City Treasurer, Mr. J. Ainsworth, said the Corporation sought to borrow the money for a period of thirty years, and there would be no charge on the rates, the Gas Undertaking being a profitable business. The plans were submitted by the City Architect, Mr. E. G. Catchpole, and at the end of the enquiry the Inspector visited the Works.

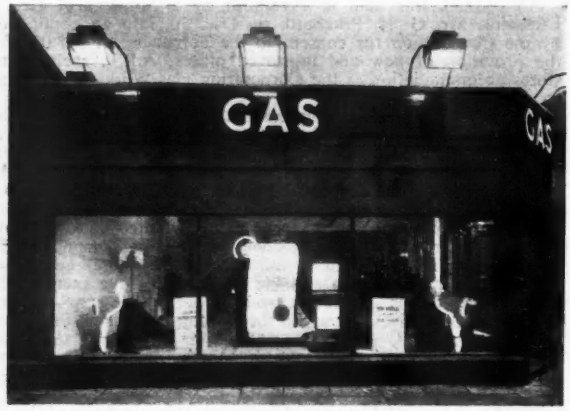
The Growing Use of Gas in Nottingham is the subject of an illustrated article in the annual trade review supplement to the *Nottingham Guardian* for Jan. 3. The writer states that one of the most remarkable features of recent years in Nottingham has been the way in which gas has displaced solid fuel for industrial and central heating purposes. The growth of the central heating load has been even more remarkable. This year's figure of 140 million cu.ft. is an increase of 12 million cu.ft. Since 1933 the figure has risen from something under 20 million cu.ft. This is mainly due, the article states, to the fact that five years ago a Special Services Section was inaugurated to deal with the development of the industrial gas load.

The Christmas Spirit at Haywards Heath



Seasonable displays marked the Christmas season at the showrooms of the Haywards Heath District Gas Company. An actual meal cooked in the demonstration theatre with two pennyworth of gas was exhibited as an example of the economy of gas cooking, while Mr. Therm's Christmas Tree was a novel idea to celebrate the first year at the new showrooms (which we described in the "JOURNAL" for June 1 last). From this tree the Company presented their consumers with gifts, including powder puffs, handkerchiefs, needle cases, soap, shaving cream, and cuff links. The tree was floodlighted and proved of considerable interest. Indeed, no efforts were spared to make all comers feel at home in the showrooms during the festive season as at all other times.

Fine New Gas Showrooms for Brighouse



New showrooms for the Brighouse Gas Department were officially opened last month by the Mayor (Alderman H. Marshall, J.P.) and have created widespread local interest. The premises constitute a very fine example of modern showroom practice, and the Department are to be congratulated on their enterprise.

The original Gas Showrooms were totally inadequate for the growth of the Department, and for some years schemes have been prepared for alternative premises. It was not possible to consider an alteration to or the purchasing of the existing premises because of the depth of the site available, and any proposed schemes had in view entirely new sites.

During these considerations certain premises were offered to the Department which on first sight appeared very unsuitable for use as Gas Showrooms, in so far as the premises were used as a factory for the manufacture of small leather goods.

The workshop was a long rectangular building 102 ft. long by 45 ft. wide with a patent glazed window roofing on each side of the double hip roof. The floor was mainly wood with a long strip of concrete laid down the centre of the building. The front was in the form of a shop and office 28 ft. wide by 33 ft. long, the shop having two very good display windows.

A Remarkable Transformation.

Mr. J. Corrigan (Engineer and Manager) prepared schemes for conversion of the premises, and the proposals were eventually accepted by the Gas Committee and the building purchased. A remarkable transformation has taken place.

The whole of the office structure was dismantled and the premises divided into three sections.

(1) The main showroom, which included the original shop and office with a total area of 3,399 sq.ft.

(2) A demonstration room with entrance from the main showroom, arranged across the building to dimensions of 45 ft. long by 23 ft. wide with a ground area of 1,035 sq.ft.

(3) Behind the demonstration room, the rear of the premises have been partitioned off and retained as showrooms for reconditioned appliances or industrial and large-scale appliances. The layout permits lorries to enter direct into the secondary showroom.

The advantages of the building are that the whole of the displays, demonstration showrooms, and secondary showrooms are on the ground floor, with special loading facilities in the rear for cookers, &c. The moving of heavy appliances is thereby greatly facilitated.

A new ceiling has been fixed above the main showroom and demonstration room. The layout of the building has been broken by the use of partitions, and special attention has been given to the grouping of various types of appliances, but at the same time allowing a complete view of the showroom from almost any position. False walls and pillars have been built to accommodate the new gas fire flues as there were no chimneys in the old building.

The demonstration room, which will accommodate 150 people, is heated by a separate gas-fired central heating boiler, thermostatically controlled. The hot water appliance display panel was fixed on to a brick wall in close proximity to the only existing drains and water supply in the building.

The whole of the flooring in the demonstration and main showrooms which originally consisted of sections of composition, concrete and wooden flooring has been covered with a new maple floor. A number of laylights have been incorporated in the new ceiling in such a position as to borrow the light from the patent glazed roof, and a very pleasing effect is obtained. Ventilating lights have been fixed in the showrooms and are successfully lighting and ventilating the premises.

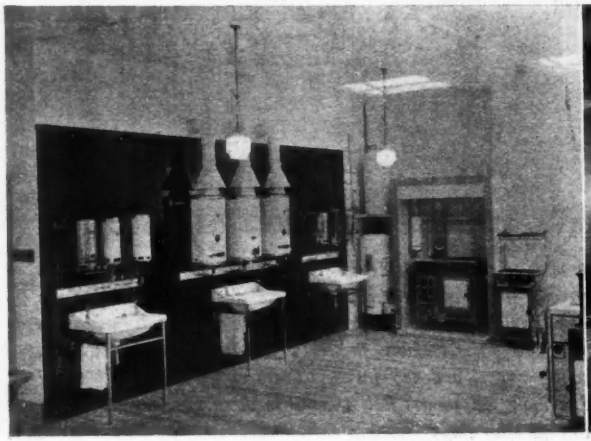
Particular regard has been given to the layout of the appliances. No attempt is being made to crowd the showroom, but appliances are arranged to assist easy selection and ease of selling.

Cookery demonstrations were held in the week following the opening, the lectures being given by Miss Arlidge, of Messrs. John Wright & Co., Ltd. (Radiation Ltd). The attendances throughout the week were very encouraging, and the accommodation in the showroom was taxed to the utmost. The premises were extremely well patronized by the general public, who are encouraged to walk round and inspect the premises at their leisure. Over 2,000 people visited the displays during the first week.

The Opening Ceremony.

The opening ceremony took place in the demonstration room, where Alderman E. E. Webster (Chairman of the Gas Committee) presided over a large gathering of members of the Council and Corporation Officials and their wives.

Alderman Webster said this was a very important day in the



history of the Brighouse Gas Department. For some years it had been realized that the previous showroom premises were inadequate and not in keeping with modern ideas. Great credit was due to Mr. Corrigan for the transformation, and to-day the Gas Committee could be proud of the premises which they now offered to the public.

The Mayor congratulated the Gas Committee on providing the people of Brighouse with what must undoubtedly be one of the finest gas showrooms in Yorkshire. The Department, said Alderman Marshall, had made remarkable progress during the past few years. The output of gas since March 31 last had broken all records; to date over 5 million cu.ft. more gas had been sold than in the corresponding period of the previous year, while the number of gas appliances on the district had been increased by over 2,500 during the past two years. In conclusion, the Mayor expressed the hope that the Gas Department was entering upon another period of progress. He had great pleasure in officially opening those magnificent premises.

Glasgow Gas Department

Open New Showroom

New showrooms were officially opened on Dec. 23 by the Glasgow Gas Department in Dumbarton Road, Clydebank. The premises have been reconstructed for their present purpose by the Glasgow City Engineer. The frontage, with its two windows, is finished in black marble, and the interior is decorated in black, green, and cream. A representative range of gas fires, cookers, water heaters, and refrigerators is displayed, and a section of the premises has been set aside for the payment of accounts.

Councillor THOMAS WILSON, J.P. (Convener of the Glasgow Corporation Gas Committee), briefly performed the opening ceremony, after which the company adjourned for tea. Councillor Wilson presided, and among those present were Mr. J. W. McLusky (Gas Engineer and Manager), with Mr. D. D. Burns (Secretary of the Gas Department), Mr. A. Bujnowski (Chief Sales and Publicity Officer), and Mr. A. Campbell (Showroom Manager).

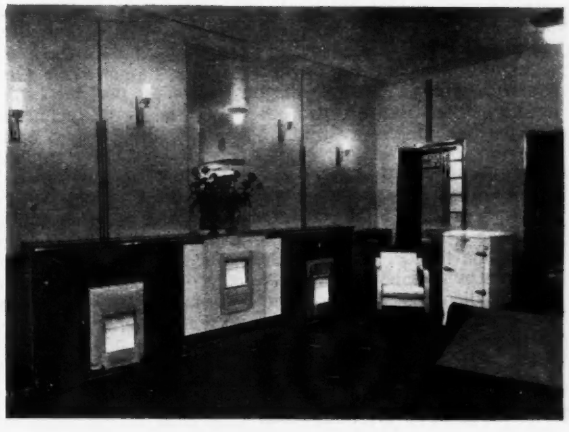
Councillor Wilson, proposing the toast of The Burgh of Clydebank, said it was their intention to invite the Clydebank Councillors and officials to come to Glasgow and inspect their various gas-works. The history of gas in Clydebank went back as far as 1871 and it had taken its supply from Glasgow for many years. It was not a specially large town but its population of 48,000 had 13,700 consumers of gas and the annual consumption was larger than in many towns like Motherwell or Kilmarnock. Glasgow's price for gas was among the six cheapest in the country and Clydebank shared in this benefit. Glasgow works carbonized one hundred tons of coal every hour, and that week had reached for one day an output of 41 million cu.ft. One had to go back to a period of fog some years ago to get similar figures. New showrooms had been badly needed in Clydebank and the premises they had constructed were a credit both to the town and to Glasgow Gas Department.

Good Gas at Cheap Rate.

Replying, Provost W. H. Martin said that Clydebank was much smaller than Glasgow and did not attempt to ape her in any way. They would, however, resist any attempt to see their town absorbed by Glasgow. They were grateful to Glasgow for what she had done for Clydebank in the way of tramcars, gas, and sewage. At one time Clydebank paid more for its gas than the Glasgow consumers, but now the price had come down to a moderate figure. They were getting splendid gas at a cheap rate. They were glad to have this new showroom in place of the premises they had previously. They now had a place worthy of their main street. No longer would Clydebank people need to go to Glasgow to see appliances displayed. Continuing, Provost Martin said that he had found by practical experiment in his own home that gas was 50% cheaper for cooking purposes than electricity. The Town Council had an all-electric housing scheme but had now resolved to take out the electric stoves and go back to gas. They had decided, in an effort to remove shadows, to light their streets with electricity, but he understood that in Birmingham they had a shadowless system of gas street lighting, and if Glasgow could bring that to their notice, they would prefer in Clydebank to use gas rather than take electricity from an outside company.

Proposing the toast of "The Corporation of Glasgow," Bailie Waterson said that Glasgow was one of the most progressive of municipalities and its recent housing developments had been remarkable. Although in outer areas Glasgow could charge 50% more for its gas, it gave Clydebank the same value as it gave its own citizens.

Replying, Bailie Ritchie said that the experience of Glasgow, like that of many other places, was that where electricity had been introduced there had also been a marked increase in the gas output and the number of consumers. The two industries were complementary, and what they wanted to-day was the more scientific use of the raw coal.



Bailie E. M. Dalgleish proposed a vote of thanks to Councillor Wilson for presiding and to Mr. J. W. McLusky and his staff for their work in connexion with the showroom.

Mr. J. W. McLusky said that the Glasgow consumers got as good a bargain as consumers anywhere. They also received services that many other towns did not give. Since Lord Provost Paxton's day they received free cookers, which were fitted free. The old black cookers had served their purpose well; but they were now in the enamel age. The Gas Industry had no fear of eclipse; it was there at the first and would be there at the end.

A Talk with the New Livesey Professor

Recently we asked Dr. D. T. A. Townend if he would be good enough to give the "JOURNAL" the opportunity of a chat with him about his first impressions as Livesey Professor at the University of Leeds. He very kindly acceded to our request and, with some hesitancy, has agreed to our writing something of what proved to us a most interesting conversation.

PROFESSOR TOWNEND told us first of all that on his arrival in Leeds one of the things which impressed him most was the extent to which the work of the Fuel Department lies outside its four walls, and how far it depends on close collaboration with other departments in the University; for example, in their first year Gas Engineering students receive practically all their training outside it in the departments which specialize in Chemistry, Physics, Mathematics, and Engineering. In their second year, a large amount of their time is still spent in the Engineering Department, and to some extent in the Chemistry Department, although it is then that they make their first real acquaintance with the work of the Fuel Department. It is only in the third and fourth years that the men spend almost all their time in the Fuel Department, first in finishing their course work, and secondly in undertaking investigations into problems having special application to the Gas Industry. It was important to add, he said, that during this latter period they are encouraged to take other courses in the University, special encouragement being given to those in foreign languages, and in Economics.

Subsidiary Subjects for Honours Degrees.

Another most interesting feature of the work of the Department, continued Professor Townend, is that, correspondingly, it gives a number of general fuel courses which provide subsidiary subjects for students reading for Honours Degrees in other departments, and these courses are quite popular. Professor Townend thinks that the Degree course in Gas Engineering at Leeds will not differ materially from that now being started in London for a Degree in Chemical Engineering. The first three years of the Honours Degree course in Gas Engineering at Leeds is very much the same as the first three years of the course in the new London Degree in Chemical Engineering. The fourth year at Leeds is spent in investigating a gas engineering problem, whereas in London it is to be spent in further advanced courses in Chemical Engineering. As time goes on, Professor Townend hopes that the teaching work of the Fuel Department will widen, so as to include fourth year courses in such subjects as plant design generally, high-pressure gas reactions, and oil technology, for he is of the opinion that the training of men passing into the Gas Industry should, if possible, be on the widest possible basis. He told us that from his own observation he would incline to the view that University training had possibly hitherto been rather too specialized, and there was no reason why a student should not understand with advantage the fundamentals of subjects other than those in which he wished to specialize; indeed, there was a large class of students who could no doubt fill a wide need in industry without being over-specialized in any one particular branch of scientific knowledge. A class of student who appeared from the records of the Department to do particularly well was one who had already served a few years in industry before going to the University, and was then enabled to graduate with the assistance of a Technological Scholarship from one of the local Education Authorities.

Metallurgy and Refractories.

Two most important sections of the Fuel Department, added Professor Townend, were those devoted to Metallurgy and Refractory Materials, and these subjects, he remarked, were becoming of growing importance in industry and in the work of the University as a whole. They were also in growing demand among Science students as a whole.

Professor Townend, having referred to the great encouragement given to students to take vacation work with industrial concerns, said that in developing the work of the Department he would always endeavour to maintain a balanced proportion in the investigations proceeding between those which might be regarded as purely fundamental and others which were the more *ad hoc* problems of industry. Probably all would agree that its purpose as a teaching organization could only properly be fulfilled if students were enabled to gain knowledge of the latest advances both in theory and in practice. He thought it would be correct to say that the success of a scientific department to-day depended upon its reputation for original investigation, and only by keeping it in the forefront in this direction could the best young brains in the country be attracted to it, and in turn passed on to the industries which it served. In order to achieve all this, Professor Townend said that, as pointed out by Professor Cobb in his recent Livesey Report, more space and equipment would be essential; in fact, Professor Townend told us that he had brought with him apparatus and one or two young men to Leeds. In order to get going without upsetting the present activities of the Department, he had had to start up his own work in an outhouse. That would not cause him any despair, and he was on the look-out for all such forms of hospitality, but the position would soon become acute.

Speaking from a different angle, Professor Townend remarked that if there was one thing which had impressed him very much, it was the importance and the scale of the research work which is now proceeding under the Joint Research Committee; he felt sure that he need not emphasize the indebtedness of the Gas Industry to Professor Cobb for his encouragement and guidance of the work to its present standing. He thought he was right in saying that in 1910, when the Livesey Chair was first endowed, there was little organized industrial research work in the country; in fact, before about that time, when a Committee along the lines of the present one first came into being, the Gas Industry had no organization for embarking upon research, no staff, no one to choose problems or assess the value of the results, and it owed very much to Professors Cobb and Smithells for their leadership in this direction. No one could at that time have envisaged the progress which has now been achieved, and he thought that the present position was mainly the outcome of the selection of competent staffs, many of the members of which had received their training at Leeds.

Future Lines.

Asked what he thought of the general future lines of the Gas Industry's progress, Professor Townend said that he thought discretion the better part of valour; he himself confessed to the greatest admiration for the extraordinary progress which had been made in the scientific development of the oil industry during the last decade. At the end of the War, internal combustion engineers were handicapped in their desire for increased efficiencies by the problem of "knock," and in overcoming this by furnishing fuels which were immune from the defect, this industry had spared no effort; indeed, with the will to apply the latest scientific knowledge and methods, it had not only been able to get a much larger yield of motor spirit from its raw material, but had been able to convert a large proportion of unsuitable fuels into good ones. The oil industry had become, in fact, a large chemical industry. Were we to look at the Gas Industry in the same light, he thought it would be correct to say that with the knowledge and methods available to-day it should be possible by patient effort to produce from raw coal economically almost any type of gaseous fuel which might be desired. Accepting this, the question became, which fuel would the Gas Engineer choose? He doubted very much whether anyone would be bold enough to answer this question in the present state of both industrial and scientific knowledge, so that the

field of enquiry became wide—namely, which were the best gaseous fuels, both generally and for specific uses, and how best to produce and distribute them?

He felt that were any message to be asked for the Industry to-day, it would be found very eloquently in Professor Bragg's after-luncheon speech on the occasion of the last Autumn Research Meeting of the Institution; particularly was to be commended first the passage "in the world and in Nature, there was a vast amount to be discovered which could be of benefit to the Industry. They must look for it, because if they wanted to catch a fish, they must go fishing!" And secondly, "it was necessary to work with all our might for efficiency in this world if we were to stand up against countries where orders could be given and carried out more quickly. They had to set out to discover the ways in which the various parts of the Industry could work together."

Standard Methods of Testing Tar and Its Products*

Reviewed by P. Parrish, F.I.C., M.I.Chem.E., M.Inst.Gas E.

Those who recall the tests for tar products of 1900, and contrast these with what is outlined in the recently published edition of the above book, must marvel at the elaboration which the requirements of the last thirty-eight years have evoked. Not only have methods of testing been more clearly defined, and in many cases readjusted, but new tests have been evolved, to meet the growing specific needs of merchants and users.

Road tar at that time was virtually unknown. The reviewer remembers the Surveyor of the Fife (Scotland) County Council making preliminary enquiries about tar for roads in 1907. Later, in 1912, the Kent County Council advertised for a chemist with experience of tar distillation. The Surveyor of that administrative body had reached the conclusion that in the absence of a pioneering effort by them, progress in the preparation of dustless roads would be lethargic.

When one has regard to the intervention of the European War, it is not a far cry from 1912 to 1929, when the first edition of "Standard Methods of Testing Tar and its Products" was published. At that time the book was acclaimed as one affording invaluable information and guidance. Those at home who had occasion to have constant recourse to its contents were no less enthusiastic in their commendation than those abroad, who were not oblivious of its utility.

The present volume represents a thorough revision of the 1929 edition. Knowledge has accumulated in the interim, and has necessarily demanded a reconsideration of the various properties of coal tar and its constituents. The ideas of users have developed in certain regards, and the necessity has obviously arisen for the establishment of fresh criteria, by which newly-conceived requirements could be met.

Chapter 1 occupies sixty-two pages, and deals with general principles, which are clearly defined. No one will be inclined to cavil with what is enunciated here. The remarks about precautions to be exercised in the sampling of tar and tar products are not less apposite than the information about distillation principles is fundamental.

Chapter 2 embraces thirty pages, and deals with crude tar and its analysis for commercial evaluation. In this connexion one recalls the contracts of thirty years ago, based on yields of products and price realizations current at the time, particularly between Halifax Corporation Gas Department and Firth & England, who were then Tar Distillers at Castleford. The reviewer was not unconnected in those days, as representative of the referee, with such contracts. Interesting questions arose, on many aspects, particularly yields, and one would have welcomed information of the character which is now available in this chapter. It is not always an easy task to hold the balance fairly and equitably as between seller and buyer. Perhaps the introduction of co-operative schemes, with gas engineers constituting part of the Board, has led to the removal of many of the knotty questions which were peculiarly contentious three decades ago.

Chapter 3 relates to refined tar, including road tar, and covers some eighteen pages. Prominence is given to equi-viscous temperature (E.V.T.)—a method developed by the Chemical Department of the South Metropolitan Gas Company. The old method recorded viscosity at a series of temperatures, whereas now tar is characterized by its E.V.T., which is the temperature at which a tar has a viscosity of 50 seconds on the standard tar viscometer.

Chapter 4 covers tests which are applicable to crude benzole, crude low-temperature spirit, and crude light products resulting from the distillation of crude tar, having a distillation range similar to that of crude benzole.

Chapter 5 relates to light and middle oils, Chapter 6 to refined lower boiling products consisting essentially of hydrocarbons boiling below 200° C., and substantially free from phenols and pyridine bases.

Chapter 7 is peculiarly interesting, treating of the specific gravity (density), distillation, and commercial examination (water content, modified Lowe's test, and residue on distillation), of crude carbolic and crude cresylic acids, not overlooking neutral oils and pyridine bases, and the aspects of acidity and alkalinity. Equally, phenols, high-boiling phenols, and refined cresylic acids are incorporated in this section. Naphthalene, tar bases, creosote oil, crude anthracene, and pitch are the subject of equally detailed treatment in Chapters 8, 9, 10, 11, and 12. The facsimile of the U.S. Customs distillation method for creosote (American Wood Preservers' Association—Manual of Recommended Practice), constituting part of the chapter on creosote oil, is a particularly useful feature. The appendices are most valuable, and their preparation has undoubtedly involved much exacting work.

One does not care to offer criticism of a book which has been prepared with such evident thoroughness and consideration by a host of experts whose reputation and experience are unchallengeable. But as the book is likely to have a wide appeal, indeed a wider appeal than those responsible for its compilation can originally have foreseen, it would have been well if something had been said about the type of result to be anticipated, and the significance of the various tests which are recommended.

Cordial congratulations are offered to those who have worked as a team with such infinite care and thoroughness in the preparation of a book which is a model of its kind. To single out anyone for special mention would be almost invidious, but it would be ungenerous not to refer to the Chairman, Mr. H. W. James, A.R.C.S.C., who, it is known, has directed deliberations with such characteristic charm and understanding, fortified with special knowledge and experience.

* "Standard Methods of Testing Tar and Its Products." Standardization of Tar Products Tests Committee. Pp. xiii. + 434. Second Edition. London: S.T.P.T.C., 166, Piccadilly, W. 1.; 1938. Price 21s. net. 21s. 6d. post free.

Forthcoming Engagements

1939.

January.

7.—London and Southern Juniors.—Visit to Wandsworth Gas-Works.

7.—Scottish Eastern Juniors.—Short Paper Meeting at Dunfermline.

9.—L.C.C.A.—Technical Committee, Gas Industry House, 2.30 p.m.

12.—Midland Juniors.—Lecture by A. T. Green, F.I.C., of the British Refractory Research Association.

14.—Scottish Western Juniors.—Visit to Maxol Heaters, Ltd., Manchester.

14.—Yorkshire Juniors.—Paper by H. A. Fells, of Sheffield.

16.—W.G.C.—Training Committee, 11 a.m.; Executive Committee, 2.30 p.m.; Summer School Committee, 4.30 p.m.; London and Home Counties Demonstrators' Circle, 7 p.m.

17.—B.C.G.A.—Gas Industry House. Executive Committee, 11.30 a.m.; General Committee, 2.30 p.m. [*Not Feb.* 17, *as stated in last week's* "JOURNAL."]

17.—London and Southern Juniors.—Meeting at Kennington. Paper by G. S. J. Knott on "Meters and Standards."

19.—L.C.C.A.—At Gas Industry House. Finance Committee, 10.45 a.m.; Executive Committee, 11.15 a.m.; Central Committee, 2.30 p.m.

19.—S.B.G.I.—Council Meeting, 2.30 p.m.

20.—S.A.G.E.M. (Western District).—Commercial Meeting, Rougemont Hotel, Exeter, 2.30 p.m.

21.—Wales and Monmouthshire Juniors.—Meeting at Newport.

21.—Western Juniors.—Visit to Cheltenham. Paper by Leopold Friedman, of Ascot Gas Water Heaters, Ltd.

28.—Scottish Western Juniors.—Visit to Parkinson & Cowan, Ltd., Glasgow.

31.—I.G.E.—Joint Committee on Complete Gasification under Pressure, Department of Scientific an Industrial Research Offices, 16, Old Queen Street, S.W. 1, 3 p.m.

February.

1.—London and Southern Juniors.—Visit to Cricklewood Works of British Oxygen Company.

1.—Manchester and District Juniors.—Visit to Staveley Coal and Iron Company, Ltd., Chesterfield.

The Protection of Service Pipes Against Internal Corrosion

In view of the discussion on the 2nd Report of the Pipes Committee presented at the Autumn Research Meeting of the Institution, the following note concerning the protection of the internal surface of iron piping against corrosion, contributed by the Chemical Department of South Metropolitan Gas Company, will prove of great interest.

IT is a common experience that under service conditions all untreated iron or steel pipes—even when the metal is of the highest quality—undergo some internal corrosion, the extent to which this takes place depending on the rate of flow, oxygen content, and dew point of the gas.

With town gas of low oxygen content, the amount of internal corrosion is relatively small and insufficient to cause perforation even in a period of many years, but the rust may still give rise to serious consequences through partial or complete stoppage of the small orifices of gas appliances when it is of so dusty a nature as to be carried forward in the gas stream.

Examination of service pipes which have been in use for long periods shows that some finely divided rust is formed even with the best quality wrought iron, and it is evident that a means of preventing the formation of this rust is very desirable. In view of the fact that rusting is much accelerated by the condensation of vapour on the surface of the metal, a number of gas companies have dealt with the problem by drying the gas to such an extent that the dew point is well below any temperature likely to be met in the district services. This procedure has certain disadvantages; when dry gas is first distributed, the rust already present in the mains becomes more dusty and may temporarily cause a large increase in the number of dust stoppages in appliances; in addition the process adds to the complexity of gas purification.

Suitable Paint Base Required.

A method of preventing rust which has recently been examined in the laboratory of the South Metropolitan Gas Company is to coat the internal surfaces of the pipes with a protective paint. This offers some difficulties since the protective film is exposed to an atmosphere containing hydrocarbons which, at low temperatures, are absorbed by many paint vehicles, softening the paint and in many cases dislodging it from the metal surface. A paint base was therefore required that possessed good protective properties and was not affected by the condensible hydrocarbons in town gas. It was known that certain resins, both natural and synthetic, satisfied these requirements to a greater or less degree. Shellac, for example, was unaffected by benzole and so were certain synthetic resins such as those of the phenol-formaldehyde and of the formaldehyde-urea type. Paints based on these synthetic resins were known to possess good protective properties and to resist the effect of water and of acidic liquids such as the condensate from the combustion of gas even at temperatures considerably above atmospheric. Certain typical proprietary paints incorporating such resins were therefore chosen for test together with a linseed oil paint. The tests were made on 12 ft. lengths of 1 in. wrought iron and mild steel barrel. The pipes were washed with petrol to remove grease, and were coated internally with the various paints. The method used was to connect a small tank filled with the paint to the bottom of the pipe by means of a flexible connexion, and by raising and lowering the tank, the paint was made to move up and down the pipe, thus coating the inner surface.

The treated pipes were arranged in a vertical position and town gas (not debenzolized) passed through them at the rate of 40 cu.ft./hour. Arrangements were made for the gas to be either super-saturated with water or dried to give a dew point well below the normal atmospheric temperature. The test consisted of passing wet gas for a period of three days, followed by dry gas for a further three days and repeating the cycle. This procedure was adopted as being that most likely to produce finely divided rust such as would cause stoppage of burner ejectors. The pipes were inspected at approximately monthly intervals.

The following paints were examined:

(*a*) Linseed oil paint with a red lead pigment.

(*b*) A benzole resisting paint having a Shellac base.

(*c*) A benzole resisting paint having a Bakelite resin base. This paint was used with two different pigments—a graphite and red oxide.

Results of Tests.

The surface of paint (*a*) became crinkled and blistered within a period of two months, and it was feared that eventually the paint film would disintegrate, affording little protection to the metal and possibly allowing particles of paint to be carried forward with the gas.

The paint (*b*) became brittle and was detached from the metal after two months, rusting commencing on the exposed surfaces.

Paint (*c*) gave very good results. The graphite pigment, however, proved unsuitable for the particular method of application used as owing to its rapid settlement the paint film was very thin at the top of the pipes. The red oxide pigment was quite satisfactory, and the paint containing it remained unaffected at the end of six months, during which time some 170,000 cu.ft. of gas had passed.

This period of test is, of course, short compared with the great length of time for which the protection would require to remain effective in practice, but in view of the stringent nature of the test, it is considered that the application of paints of this type to the internal surfaces of pipes would bring about a very large reduction in the amount of rust formed and would afford adequate protection over long periods.

Non-Lighting Back Hotplate Burners

The constant striving for improvement in gas consuming appliances is associated with the consideration that they should also be made more convenient in use and "foolproof" for the public.

This brings us to an interesting development introduced some little time ago by Radiation Ltd., and now proved in practice as a marked step-forward. We refer to the "Self-Righting" burners in the hotplates of the latest "New World" gas cookers.

Broadly speaking, this type of burner possesses the characteristic that, over a wide range of gas consumptions, the flames are compelled to burn at the burner head and as a result of the construction of both the burner and injector, and the precise relation between these components, lighting-back to the injector orifice cannot occur.

In designing and producing a "self-righting" burner with its injector, the following among other essential features are required: A machined burner choke of definite dimensions; a specified distance between the injector nipple and the inlet to the choke. In addition, the internal contour of the burner shank must conform to certain formulæ. A high degree of accuracy both in design and manufacture is required for the successful performance of a burner of this type.

The use of the "self-righting" burner is of some interest in view of the increasing use of automatic—or semi-automatic—lighting devices in the hotplates of gas cookers. It is of importance that the automatic lighting device shall so operate as to ignite the burners at the flame ports without fail, and the use of "self-righting" burners is an additional safeguard that this object will be attained.

We feel sure the Gas Industry will appreciate the advance made by Radiation Ltd., in this matter. All improvements in gas apparatus are to be welcomed, particularly where they give to the public an increased confidence in the use of gas.

You Have Been Warned! - - -

An article contributed by a well-known fuel technologist connected with the carbonization industries, who was formerly on the staff of a colliery company.

The Fourth Coal Convention has passed, and the "GAS JOURNAL" has written its epitaph: "A platform for a full-blooded boost for the use of raw coal in the domestic fireplace." But if that is all the Gas Industry thinks about this convention and its appurtenances, we deceive ourselves and the truth is not in us. Coming events cast their shadows before, and it is often possible to deduce the future from a consideration of the present. Such, in the writer's opinion, is the present situation in the fuel industries of the nation. The position in the past has been such that coal has been regarded as a great and unwieldly monster, off which anyone who desires can carve joints to suit his fancy, but without the monster being sufficiently alive to emit more than spasmodic howls of protest when a deeper cut than usual has reached a nerve. Within the last two years or so, the position has changed. The monster, *horribile visu et horribile dictu*, has arisen on his hind legs and prepared to defend himself. Moreover, let the Gas Industry and others whom he believes to have fattened for years upon his barely animate corpse realize that the monster has enlisted in his service the resources of modern science, and is prepared to fight his supposed enemies with their own weapons.

One of the difficulties is that the monster does not speak with one voice; he is a monster indeed, for he is two-headed. One of his heads stammers, and seems a little uncertain what to say and how to say it; at different times it says different things according to what part of the country it is in. That head is called THE COLLIERY. The other head has no doubt what to say, and speaks clearly so that its voice is heard high in the councils; it is called THE MERCHANT. So long as the coal owner receives a price for his coal that enables him to pay a reasonable dividend and to pay normal wages to his men he is satisfied; it does not matter two puffs of the old winding engine to him to whom he sells it. The merchant, however, is in quite a different street. The gas company may buy coal direct from the colliery; the merchant gets no commission and makes no profit. The gas company sells direct to the consumer; not only does the merchant get no profit from the transaction, but house coal which he would otherwise sell is displaced. Consequently, it is the merchant who is behind the "burn raw coal" campaign.

It would be possible to argue that the coal-owners support this policy both verbally and with funds, and that is true. It is true for two reasons. The first is that the coal-owner has made his maximum profit in the past from the large house coal; he now sees this market disappearing in favour of products made from slack or nuts, and this change in the orientation of his business worries him. It is a change that is bound to come in time, because even if the domestic heating load is retained for raw coal, it is almost inconceivable that the householder of the future will be content to break up the coal for himself instead of buying it ready broken in convenient sizes. But the coal-owner is conservative, and he dislikes having to change his established practice, so he is not averse to fighting what seems to him to be the menace of the disappearing house coal market. In the second place, the colliery policy is dictated by the colliery agent and the colliery salesman. If there can be found two greater enemies to progress as a class than these two, the discoverer will have earned a niche among the great explorers of this generation. There are, of course, enlightened men among them, but they are all too few. The old-fashioned salesman sells to the factor or to the merchant, and his policy is that which the middleman wishes him to adopt. Even the Gas Industry knows that the customer is always right.

Allies of the Collieries.

Fuel technologists know that the gas and electricity industries are the greatest allies of the collieries; the collieries are slow to realize this, but they might be open to conviction if properly approached. The very existence of the coal merchants is threatened by the displacement of coal by gas, and under present conditions it would be impossible to expect them to be favourable to gas, even though they may appreciate the advantages of coke. There is thus war between the coal trade and the Gas Industry, and whatever the coal trade may say to the contrary, the Fourth Convention showed clearly that war has been declared.

Let us also make it clear that coke is in an invidious position. The coal merchants do a good business in coke and work happily with the Gas Industry in that direction. The Coal Utilisation Council holds up its hands in blessing whenever it mentions the word coke. The writer has an uneasy feeling, however, that in their hearts the priests of the C.U.C. say the Black Mass whenever they mention that word. The coal-owner sees that coke is a product of low-priced coal which displaces large house coal, and he does not like it—unless he owns coke ovens and can join in the market and reap profits from carbonization. The true attitude of the coal interests (outside those owning coke ovens), therefore, seems to be that coal should be used at all costs, but as a last resort use coke—never gas and electricity.

There was, no doubt, a wealth of hot air spoken on behalf of coal, both at this conference and elsewhere, but some of the remarks are worth quoting as examples of the ignorance of the coal trade in regard to gas. A contemporary referring to one of the convention Papers made this priceless comment: "Major Gillespie knows, but did not say why, although it is frequently asked, how coal mined at a cost of 15s. comes to be sold at 50s. (a fallacy); the newspapers never ask why it is necessary that gas manufactured at 1½d. a therm should sell at 9½d. or 10d. (a fact)."

An even greater gem, one of purest ray serene, was found in the chairman's remark at a recent lecture sponsored by the coal interests. Certain fuels that are supplied conveniently to the public on tap—gas and electricity being obviously referred to—had been described, the chairman said, as "canned fuels." Canned foods, he said, were useful when unexpected guests came to the house, but no one could say that canned food was as nourishing as fresh food. In exactly the same way, he maintained, "canned fuel" could not be so good as fresh fuel—*i.e.*, coal!

These two examples have not been inserted to amuse. They are regarded as important because they show the lines of the direction in which the coal industry is preparing to make propaganda against the use of gas. It will be said that the Gas Industry is profiteering, and should pay more for its coal—thus making it necessary to supply dearer gas and handicapping the Industry; and gas will be contemptuously referred to as "canned fuel," thus endeavouring to discredit gas by spurious analogy, which will appeal to the unintelligent portion of the population.

The Position of Coke.

Thus far, we have given a general explanation of the attitude of the coal industry towards gas and coke. We now come to the more serious part of the subject. If it were simply a "slanging match" no doubt we have sufficiently sound arguments and an adequate command of vituperation within the Gas Industry to hold our own. We have said that the coal industry is meeting the competition of its supposed competitors by scientific research. And this is the only sound way in which commercial competition can be met. Let us also make no mistake about the position of coke. It is of vital importance to the Gas Industry that there shall be an adequate market for coke at reasonable prices. If coke is attacked, the price of gas may have to be advanced because an adequate return is not obtained from this by-product. An attack on the coke position is a flank attack on gas.

There are two methods by which coal can be burnt virtually without smoke for domestic uses, and we shall discuss each of them in turn. The first is by means of the automatic stoker for closed stoves, central heating boilers, and the like; and the second is by the use of Welsh steam coals for the open fire. It has recently been written regarding the automatic stoker that "The introduction of the auto-

matic stoker has not only arrested the increasing use of oil, gas, and electricity for heat, but has enabled coal to regain recognition as the correct fuel for safety, cleanliness, economy, and efficiency." That shows in what direction the coal trade is moving; and the fundamentally important fact is that these claims are virtually true.

And in regard to Welsh coals it has been written by one who has conducted an investigation into the subject. ". . . South Wales coals . . . are in every way suitable for use in open grates designed for burning gas coke."

The coal industry has learned from America. The U.S.A. was the home of the automatic stoker, and there can be little doubt that in so far as American practice is suitable for this country, American methods will be introduced here. It will be instructive to see what is being done across the Atlantic, and our purpose will be served admirably by some Papers published by the University of Illinois earlier in the year that were presented at "an educational programme of technical and practical information pertaining to coal and its efficient utilization for the benefit of those engaged in mining, preparing, marketing, and distributing machinery for the preparation and utilization of coal."

American Practice.

There are many practices which seem to be commonsense that are coming into operation in America that have not yet been introduced here, or if introduced have not yet made much headway. It would not be a very long shot to guess that the British coal marketing interests, having now become awake, will presently adopt these methods. For example, coal is damped with calcium chloride solution to prevent dust on delivery. It is sized and delivered in the grade best suited to the consumer's purposes. Coal order offices are probably much the same as ours, but the practice is coming into being of following the lead of the Gas Industry, and situating the coal office in a populous shopping centre, with comfortable rooms, and a first-class display of coal-burning appliances and of coals suitable therefor. Here is an extract which shows the effect of this policy; it refers to a specific instance of a coal merchant who "went modern": "He graduated from the railroad tracks, tore down his office there and moved to main street to open his office. The first Saturday night in his new office brought more customers than he had had in a year in his old location down on the tracks . . . He is catching some of the customers on their way to or from the utility company [read 'gas company']. Is it unreasonable to suppose that if the utility company maintained their principal office down on the railroad tracks instead of up on main street their sales would have shown the same consistent growth?"

Coal is being distributed in containers. Here is another aspect of the situation: "As they battle, each participant, coal, oil, gas, and electricity, is developing new and better methods of generation and utilization, with the result that the combatants are benefiting not only themselves but all business and industry as well. . . . To help retailers, the processing and preparing of coal has gone so far that many miners are actually manufacturers, with their mines becoming merely their sources of raw materials. Packaged coal is common, and since many kinds of coal can lose heavily by open-air evaporation [perhaps oxidation is meant], dated coal in airtight bags may be expected any minute."

Moreover, the coal trade is uniting to handle complaints. An instance is given of Kansas City, "a town in the hotbed of gas and oil competition," where the producing, wholesale, and retail coal people united in 1927 to organize the Kansas City Coal Service Institute specifically to deal with complaints. The superintendent of this organization writes: "From May 1, 1936, to May 1, 1937, I personally answered 1,185 complaints on coal or coke . . . the causes of complaints were divided as follows: Inferior coal 5%; faulty equipment, 26%; faulty firing, 20%; unwarranted complaints, 24%."

There can be no doubt that a similar policy will be introduced here in time, and will lead to far more difficulty in displacing coal by other fuels than now exists. It will be admitted at once that the more intense fight between coal and gas in the U.S.A. results from the fact that nearly half the American consumers are supplied with natural gas, not derived from coal. The Papers quoted, however, make no distinction whatever between natural gas and coal gas. It is still true in America that since the coal merchants derive no benefit from the sale of coal gas they regard gas as their competitor.

A Suggestion to the Gas Industry.

Before leaving this side of the subject, the writer wishes to make a suggestion for the very serious consideration of the British Gas Industry. It is this. Let us ask ourselves why there should be antagonism between coal and gas. Let us ask ourselves why the coal owners do not recognize gas and coke as their allies. We shall find if we get together that there need be no fundamental divergence of views. We shall find that a price for coal can be agreed upon—all being reasonable people—that will be regarded as fair by the coal-owners even though it may mean that they will for the future have to break up large house coal for other purposes. Calculations published by Mr. W. L. Boon and Dr. G. E. Foxwell in a Paper before the Coke Oven Managers' Association earlier in the year show that already the Gas Industry is probably paying such an economic price. It then remains for the Gas Industry to cheapen its methods of production and of distribution in order that gas can be sold at an attractive price. Kensal House and the all-gas houses at Newcastle and other places show what can be done when the Gas Industry rolls up its sleeves. By agreement with the coal owners much could be done to give us a co-operative effort to improve the domestic fuel utilization of the nation. That, however, leaves us with the difficult problem of the merchants. The further suggestion is here made that the Gas Industry should study to evolve some method by which it will pay the coal merchants to participate in the sale of gas to domestic consumers. In other words, to make the coal merchants into gas salesmen. If we come to an arrangement now, the path of the Gas Industry may be greatly eased in the future, and solid advantages to the coal industry and to the population generally may accrue. If we do not come to an arrangement, and we let a state of intense competition develop, the Gas Industry must take warning from what is being done in America and here that in the future the competition between gas and coal will be at least as intense as that between gas and electricity, with the added disadvantage that coal is already in entrenched positions, and that, generally speaking, coal is cheaper than gas for continuous use.

This, however, is not the whole story, and those who have not by now been convinced of the potential seriousness of the position should read on a little further. We will consider the disadvantages of coal. It is stated, said Mr. J. G. Bennett at the Fourth Coal Convention, that coal is inconvenient and dirty; and this is the substance of the anti-coal campaign. Further passages will later be quoted from his Paper, but that is sufficient for the present purpose—coal is displaced by gas because it is inconvenient and dirty. Let us turn back to the American papers, and see how these disadvantages are being overcome in that country.

(To be concluded.)

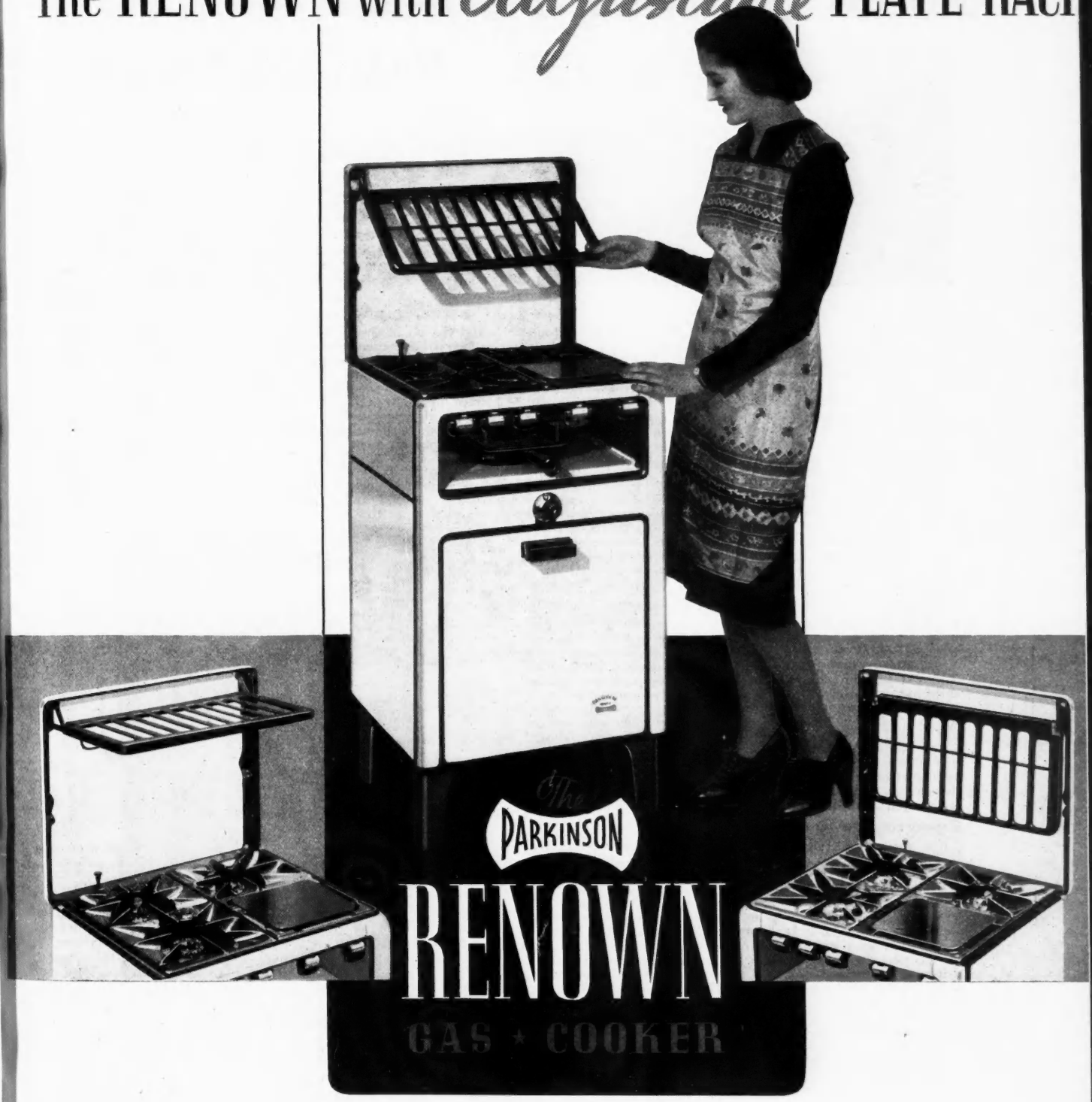
Gas and Water Engineers' Calendar, 1939*

The new edition of this well-known desk companion, now a hardy veteran of sixty-one, reflects the recent changes in the geographical situation, for the Austrian and Sudeten gas and water works are included in the list of German undertakings. The title of the book has also undergone a change, the volume having been raised in dignity from a Calendar to a Yearbook.

A new feature is a page of statistical information relating to the German Gas Industry, including both the gas-works and the coke-oven sides. It is to be noted that there are still some 590 000 gas lamps in use for street lighting. In spite of the prominent position which the Gas Industry holds in Germany, the tonnage of coal carbonized in the gas-works is but a small fraction of that handled in by-product plants, an indication of the importance of long-distance gas transmission in that country.

* Jahrbuch für das Gas-und Wasserfach, 1939. [Munich and Berlin, 1939. R. Oldenbourg. Pp. 463. Price RM. 5, bound.]

The RENOWN with *Adjustable* PLATE-RACK



The folding plate rack incorporated in the cover of the Parkinson 'Renown' is a feature of real appeal to the housewife. In daily use, the fact that this plate rack is adjustable, enabling a tall steamer to be used, presents another advantage.

The success of the 'Renown' cooker has been achieved by the combination of features of outstanding practical value with sound construction and attractive appearance.

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Two Interesting Pipelines Near Scunthorpe

Towards the end of 1937, Nitrogen Fertilisers, Ltd., of Ipswich, had decided on the acquisition of land and the construction thereon of a complete new works on the banks of the River Trent near the village of Flixborough in Lincolnshire. In connexion with the scheme, it was decided to purchase a supply of coke oven gas from John Lysaght, Ltd., of Scunthorpe, and pipe this gas from the coke ovens at Normanby Park Works down to the new works site at Flixborough.

SURVEYS and investigations were made as to the best route for the pipelines, and eventually an agreed route was fixed, practically running parallel with a new line of railway then being constructed by John Lysaght, Ltd., between the same two points. The survey and plotting of a longitudinal section disclosed the advisability of running the first section of the two pipelines overhead in the Normanby Park Works for a distance of about ¼ mile. Throughout the remaining distance of about 1¼ miles it was found advisable to lay the pipelines underground at a depth of 3 ft. 6 in. (2 ft. cover). An easement and wayleave was obtained, and estimates of construction costs revealed the fact that the underground method would be more economical than overhead for this particular section. The route having been decided, it was next necessary to design the pipelines. Two mains were required, one for conveying the gas from the coke ovens to the fertilizer works, where certain chemical constituents of gas were to be removed and used in the manufacture of fertilizers, and the second main was required to convey the residual gas—still having a considerable and valuable calorific value—back to the steel works for further use there.

Consideration of requirements necessitated the first supply main to be of 18-in. diameter and the return main to be 14-in. diameter. These dimensions were definitely fixed, and it was decided that the mains be of steel and generally in accordance with British Standard Specification for welded mains (B.S.S. No. 534). The underground mains were to be coated for protection against corrosion in a special way known as "proof wrapped," which is a bitumen and asbestos wrapping material, or alternatively, double wrapped with jute hessian cloth impregnated with hot bitumen and applied spirally so as to give an impervious bitumen coating.

The overhead lines were to be protected against the weather by two coats of special anti-corrosive paint, one coat (grey colour) applied at the tube manufacturers' works on cleaned tubes before despatch and the second and final coat, black graphite paint, after erection on site.

Supporting the Overhead Mains.

The method of supporting the overhead mains through the Normanby Park Works was on specially designed light steelwork trestles, erected on concrete bases and carrying the two mains on cast-iron rollers. The trestles varied in height from 3 ft. to 17 ft., and were placed generally at intervals giving a span of 30 ft. Two long spans were over 45 ft., because of several lines of railway sidings on which it was impossible to erect supports.

The paint work specification for the trestles was similar to that on the steel mains, except that the trestles were fabricated and delivered to site unpainted and allowed to rust to remove mill-scale. After the completion and testing of the pipelines the trestles were scraped, wire brushed, and painted with one coat of anti-corrosive grey paint and one coat of black graphite paint as for the steel pipelines.

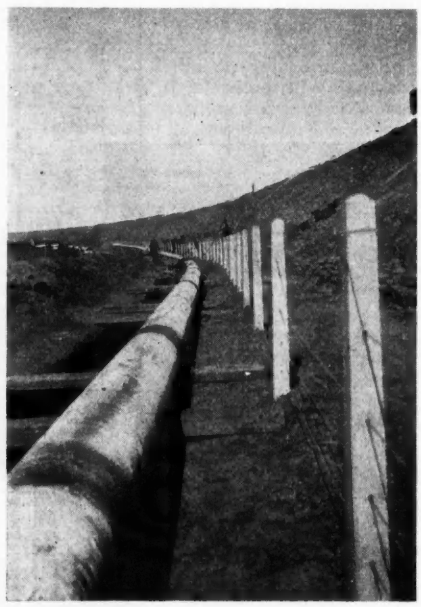
Most of the steel bends on the overhead and underground lengths were fabricated on site owing to the uncertain angles of deviation both vertically and horizontally from the straight. They were gussetted and butt-welded—all welding being by the oxy-acetylene process.

The expansion on the overhead lines was taken care of by fitting Johnson expansion couplings every third joint—that is, a sequence of two welded joints and one Johnson coupling. This not only allowed for expansion, but facilitated erection, as all the welding could be done on the ground and only the Johnson Coupling Joint made overhead on the trestles. No allowance was made for any expansion on the underground mains as this was found to be unnecessary.

Throughout the two pipelines there were no branches required, and the only other special fittings were steel drainage pots (or syphons) to collect any condensate that might collect at low points. These syphons were inserted in the pipelines with welded joints, and were fitted with the usual dip-pipe for emptying purposes. To obviate electrolytic corrosion six earth plates were fitted in good electrical contact, so as to keep the steel mains always at zero potential.

The whole of these pipelines were designed and constructed for a working gas pressure of 3 lb. per sq.in., and were tested by compressed air during construction, and on completion to 15 lb. per sq.in.

The contract for the supply, delivery, and erection was placed on Jan. 27, 1938, and all materials ordered within two days there-



after. The trenchwork, which was done mechanically, using a 25 Super-Duty Allen-Parsons trenching machine, was commenced on March 1 and the whole of the pipelines completed from end to end and tested in 20 weeks (2·1 miles, or 4·2 miles of single main).

No physical difficulties underground or bad weather of a serious nature occurred, and all went according to plan to the satisfaction of all concerned.

The various contractors for the job were as under:

GENERAL CONTRACTORS—E. E. Jeavons & Co., Ltd., Civil Engineering Contractors, Tipton, Staffs.

PRINCIPAL SUB-CONTRACTORS—

Steel tubes, fittings, and couplings—Messrs. Stewart and Lloyds, Ltd., London and Birmingham.

Steel trestles and supports—Messrs. Horseley Bridge and Thos. Piggott, Ltd., Tipton, Staffs.

Paint and steelwork protection—Messrs. Docker Bros., Birmingham.

Gas in Industry and Commerce - - -

by
N. H. GREENWAY,
of Cardiff.

From a Paper before the Wales and Monmouthshire Junior Gas Association at a meeting held at Cardiff on Nov. 19.

In non-ferrous work, soft metal melting offers a wide field for gas sales, the chief uses of soft metal being in the printing, tin plating, galvanizing, and moulds of various kinds, for instance, in the manufacture of dental plates.

Immersion heating is being widely used at the present time in this connexion, and it offers many advantages over the usual type of pot heating. The heat is located where it is most required, in the metal itself; this means that the metal is at a higher temperature than the pot. A higher thermal efficiency is claimed for this method, and a reduction in dross formation.

There are different methods of firing in immersion heating, which will, of course, depend upon conditions of working and cost of installation. Fig. 1 illustrates the method in which a pre-mixture of the air and gas or carburation is required.

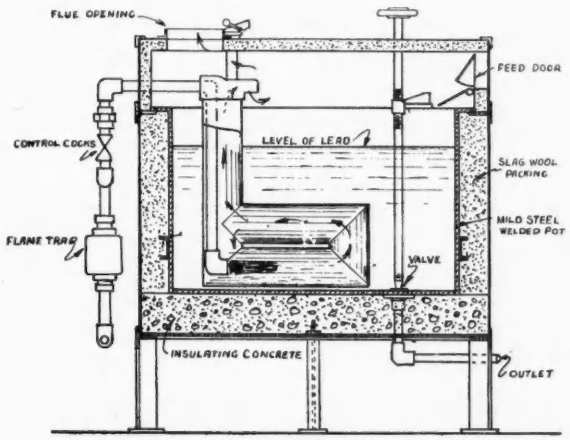


Fig. 1.—Kemp Immersion Heater.

Other methods of firing include one whereby the base of the furnace beneath the pot is filled with broken refractory, which is heated by a gas burner. The refractory is thus raised to incandescence, giving radiant heat to the pot. This method is modified in the radiant heat process employing surface combustion.

In non-ferrous work, we frequently encounter brass, and this means higher temperatures than with soft metal work. Manufacturers realize the excess cost of cutting and machining brass parts. Hot brass stamping or forging is increasing to a great extent, as it offers a density of metal through which there can be no seepage or porosity. The process of stamping is to heat a billet of suitable size and shape in a gas furnace to a temperature between 1,500° and 1,600° F. The billet is then placed in the die where it is pressed into shape.

Interesting Installations.

The Cardiff Centre was recently approached by a local wire rope manufacturer for means of heating petroleum jelly. In this process after the final operation in the manufacture of wire rope, the rope is passed through a bath containing petroleum jelly raised to a temperature of 180° F. This ensures that the wire rope shall be well protected from any corrosive action, at least until its delivery. Electrical immersion heating was tried in the above case, but proved unsuccessful due to the fact that the carbon in the petroleum jelly carbonized the resistance unit casing, rendering it ineffective.

When converted to gas firing, burners were made up to suit each bath. These were fixed beneath the baths and, in conjunction, thermostats fitted. Immersion heating would not have been practicable in this case, due to the shape of some of the baths, and constructional alterations would have been necessary, which was not desired by the manufacturers.

The manufacture of furniture and boot polishes throws an interesting light on the manner in which an Industrial Centre can influence the cost and quality of a product produced with gas fired equipment. Some years ago a factory was started to produce polishes in our area, and the original equipment installed before an Industrial Department had been initiated consisted of 6 water-jacketed boilers, each heated with a ring burner consuming approximately 75 cu.ft. per hour. This equipment served its purpose and melted the compounds placed in the pan, but after a few years the Directors complained that the cost of using gas for melting was much too high and that, owing to increased output, the plant was much too slow.

It will be realized that a long melting time meant a serious delay in completing the other processes, and occasionally the whole of the factory would be held up until melts were completed.

The newly-formed Industrial Department made a thorough examination of the problem, and suggested to the Directors that improvements could be effected by completely re-designing the plant, at a cost of several hundred pounds. The Directors decided to place the job in the hands of the Industrial Department. To appreciate the difference in the existing and the proposed methods of operation, it is necessary to digress for a moment and consider the processes involved.

With the original plant the schedule of operations was as follows. The waxes and other compounds were melted in the pans and, after cooling, the constituents were added. The mixture was agitated by hand and ladled to storage tanks at a temperature of 100° F., where further agitation was effected. The tins were then filled with liquid polish from this tank.

The proposals put forward by the Industrial Department consisted of replacing the water-jacketed pans by a gas-fired steam boiler and six cast-iron steam-jacketed pans. The idea of this being to decrease the melting time by availing ourselves of the greater temperature difference between the steam and the hot water previously used. Furthermore, the pans were connected in a line with a pump, the casing and the piping of which were steam jacketed, thus enabling the polish to be pumped from either one or all of the pans to the storage tanks, without losing heat. In addition, a gas engine was fixed to work the pumps and agitators in the storage tank. Finally, owing to the increased speed of melting, it was arranged to supply cold water to the steam jackets, after melting, to reduce the temperature of the solution quickly while the more volatile solvents, &c., were added.

Some idea of the improvements effected can be gathered from the following:

	Water Jacketed Pans.	Gas Fired Boiler and Steam Pans.
Time for first melt	3½ hr.	1¼ hr.
Cooling time	1 ,,	20 min.
Time for first cycle	4½ ,,	1 hr. 50 min.
Gas used for first batch	220 cu.ft.	150 cu.ft.
Time for second and other batches	1¼ hr.	45 min.
Gas per batch	95 cu.ft.	60 cu.ft.
Average consumption per batch per day	120 ,,	78 ,,

For some years this plant worked successfully, and the Directors purchased more gas-fired appliances for space heating, laboratory use, &c., being extremely pleased with the results.

About two years ago a fire completely gutted the building and ruined the plant. Being forced to find new premises, the Directors again approached the Industrial Department to ascertain if a much more rapid method of working could be

effected to enable a greater output to be produced in a more confined space.

A local firm who manufactured gas appliances had recently introduced the Radi-heat system of heating, and an experimental unit of this type was installed on test at the factory. By using a carefully controlled mixture of burnt gases and air, it was found possible to keep the temperature of the gases down to a limit, which, although effecting remarkably quick melting, did not affect the quality of the product through over-heating.

This unit was so successful that, as the following table will show, it does the work of the six previous pans combined:

	Radi-heat Unit.	Gas Fired Steam Boiler.
Time for first melt	35 min.	1½ hr.
Cooling time	5 ,,	20 min.
Time for first cycle	40 ,,	1 hr. 50 min.
Gas used for first batch	40 cu.ft.	150 cu.ft.
Time for other batches	25 min.	45 min.
Gas per batch	23 cu.ft.	60 cu.ft.
Average consumption per batch per day ..	26·5 ,,	78 ,,

A further advantage is that during the cooling period the pan is run on cold air with the gas off, and thus reduces the temperature within 4 to 5 minutes.

This method of heating is proving extremely popular for a variety of industrial and commercial purposes, and as this instance shows, enables the utmost economy to be given to the consumer.

Commercial Consumers.

The commercial consumers which come under the attention of Industrial Centres may be classified chiefly as bakers, fish fryers, and dairymen, and it is in the baking trade that the keenest competition is met from other fuels. The small baker and confectioner is inclined to favour coke as a fuel, and gas must be sold at a figure of 4d. to 5d. per therm if the baking load is to be won over to gas, and gas stands second to none in its adaptability, ease of control, and reliability in this field. An instance to my knowledge is that of a baker and confectioner in our area who was using electricity for his work, which consisted chiefly of making meat pies and pastries. He expressed dissatisfaction with his working costs, and asked us whether we could offer an improvement by installing a gas-fired baker's oven. We accordingly installed a Mabbott portable type 3-deck baker's oven, the maximum gas consumption being 180 cu.ft. per hour. This was rather high for the class of work undertaken in this oven, so the injector nipples were reduced to give a consumption of 120 cu.ft. per hour. When this oven was put into use a considerable saving was effected, in addition to the fact that nearly three times the original baking space was available, which meant that baking was finished several hours earlier than previously.

In every town there are fish fryers who, if not already using gas, should be made aware of the benefits to be obtained by going over to gas. There are approximately 35,000 fryers in this country, and the gas consumption for a gas-fired range varies from 50,000 cu.ft. to 300,000 cu.ft. per quarter.

The recent inroads on this load made by a few electricity undertakings have proved that, with electricity at 0·3d. per unit, it is comparable with gas at 8·0d. per therm. It is therefore obvious that, to meet this competition, gas must be available at rates between 6d. and 7d. per therm. It may be taken that 24 units of electricity are equivalent (for fish frying) to one therm of gas, provided that the gas is used in a modern efficient range. The amount of food cooked by one therm of gas varies somewhat with the range—for instance, a conventional natural draught range may cook 6 stones per therm, while the Radi-heat approximately 1 cwt. per therm.

Another important point with fish frying is the presence of objectionable vapours in or around the premises. With the old-fashioned coal ranges, so much heat was lost up the flue that a natural suction of steam occurred. With the natural draught gas-fired range the heat passed into the flue is so much less that it is often difficult to obtain effective ventilation. On certain ranges the use of a small pan guarantees complete freedom from steam or vapour, and in addition, by providing a constant pull on the combustion chambers, it ensures efficient combustion under all conditions. Another improvement is the method of utilizing radiant heat for frying. A large amount of the thermal energy is passed from the radiants to the pan bottom, and the tendency towards the formation of a "cold film" is averted. In addition, on the "Radi-heat" range an automatic flue damper is fitted to each pan which automatically seals the combustion chamber after the gas is shut off during slack periods, thus retaining cooking temperature for 30 to 40 minutes.

Gas in the Dairy.

Dairymen use heat in their business for sterilization and pasteurization of the milk, and also for the cleaning and sterilization of bottles and utensils. This is best accomplished by means of a steam boiler which will supply steam to the various units. The object of pasteurization is to destroy certain organisms which may be present in the milk and postponement of souring. To effect this the milk must be retained for at least 30 minutes at a temperature not lower than 145° F. and not higher than 150° F. and rapidly cooled to a temperature of not more than 55° F. Actually it should be cooled to and kept at about 38° F., but the figure of 55° F. is used to cover those producers who do not posesss a refrigerating plant.

It is, of course, useless to subject the milk to the above treatment unless cleanliness is enforced throughout the after process, so that the pasteurized milk shall not become contaminated by dirty churns and bottles. Sterilizing of bottles is accomplished by placing the bottles in a cabinet to which steam is admitted for a few minutes. Low pressure steam is used, 2 lb./sq.in. being sufficient. Hot water may be obtained from the boiler for washing bottles and churns and for general use in the dairy.

A gas-fired steam boiler is ideal for this purpose, being more efficient and adaptable than independent units for the same purpose.

Discussion.

Mr. F. S. JOHNS (Swansea) asked whether the overhead radiant heating system came under the cheap central heating rate, and whether any difficulty was experienced in Cardiff with fish ranges not being able to cope with the work during rush hours. It was his experience in Swansea that on Saturday nights a fish fryer complained of his range not coping with the necessary work. He had taken gas pressures and found them to be constant.

Mr. GREENWAY said that at Cardiff overhead radiant heating did not come under the cheap rate, which applied to central heating only.

Mr. H. V. WILLIAMS (Cardiff) asked the Author whether he recommended the high or low temperature type of overhead radiant heater.

Mr. GREENWAY, replying, said they both had their definite application, the high-temperature type being useful for large works and halls, whereas the low-temperature type found its use in churches and other halls, where head room was a dominating factor. Also for the latter type, electricity was not required.

Mr. W. R. BRANSON (Cardiff) asked whether there was the possibility of obtaining a lighting load in factories in Cardiff; in London it was common to find gas lighting where gas was being used for heat treatment.

Mr. B. J. BELL (Cardiff) urged all to take advantage of the recommendations of the Home Office Report on Factory Lighting.

A vote of thanks to Mr. N. H. Greenway was proposed by Mr. R. T. MILLS (Cardiff) and seconded by Mr. D. W. REES (Neath).

Kitchen and Still-Room Equipment

To those concerned with the catering load a series of leaflets issued by Messrs. G. F. E. Bartlett will be of interest. These deal with a number of useful gas appliances for kitchen and still-room use, including counter water boilers, combination urns, bain maries, steam heated water boilers, caterers' portable boilers, pastry and vegetable warmers, and steam cookers.

Some of the urns are shown in new designs fully in keeping with modern requirements. Different patterns of heat retaining insulated urns are described in the case of water-jacketed urns the firm offer a choice of lining in earthenware, Pyrex glass, enamelled steel, cast aluminium, or stainless steel to meet individual preference.

Practical Considerations in Mainlaying

by
A. C. REA, Perth

From a Paper to the Scottish Junior Gas Association (Eastern District), Nov. 26.

The following notes are based on the experience gained in laying a high-pressure main from Granton to Broxburn, and other gas distribution work.

In mainlaying a beginning should be made with a small squad for a day or two until the equipment is established and some ground opened, before working up to the full size of the squad. This will vary with circumstances but I believe in the numbers being as large as practicable.

I used two lots of about 60 men working at a distance of 4,000-5,000 ft., near enough to be supervised by one man, and also used the same major items of equipment. This method allows the work to advance in steps without having too lengthy openings at any one place and further permits of each section under its own foreman competing to some extent with the other and thus acting as an incentive to the foreman and his men.

Testing for Tightness.

The testing of the mains laid is a very important point and in order that this may be effective and expeditious the main is sectioned into the "steps" used in above method of laying. At the beginning of a section a steel plate is welded on temporarily and this serves for testing against, while the section is being laid. As the section is laid it is tested in 500 to 1,000 ft. lengths, or as circumstances and time dictate, thus allowing filling in and closing of the track as more is opened. During testing, the leading end of the main is closed by a cast iron cap, which has had the inside turned out to give a slight taper toward mouth for easy removal after testing. A 1-in. tapped hole off centre is used for connecting the high-pressure air pipe from air compressor. A lead run joint caulked to withstand the test pressure (25 lb. per sq.in. in this case for 15 lb. per sq.in. maximum working pressure) is used, and the cap is supported by battens in case of blowing off.

The time of compressing is proportional to the length, hence the desirability of keeping this within reason, by sectioning. Also where a pressure gauge is used as a general guide to tightness of the main, its effectiveness to reveal leakage diminishes with the length under test. All joints are tested by soapy water applied by a soft-haired brush, and any small leakages caulked tight. Serious leaks will require re-welding after the pressure has been released from the mains. Soapy water is preferred to oil for joint testing, as it reveals small leaks more easily.

Tests should be left on overnight or during week-ends on long sections so that the pressure gauge may reveal any leakages. Drop or rise in temperature will influence the pressure and must be allowed for. It is essential to employ a reliable gauge (preferably two together) so that readings can be trusted to be accurate.

To instance a case where a leakage was detected by gauge in a 15 in. main, the following observations were made during the testing of sections, when laid progressively:

1. Date.	Length Under Test.	Pressure, Lb./Sq.In.	Time of Test.
May 29.. ..	230 ft.	25	9 a.m.–12.30 p.m.
June 6.. ..	1,583 ,,	26	4 p.m.–9 a.m.
,, 14.. ..	2,466 ,,	26–28–27	12 noon–4.30 p.m.–9 a.m.
,, 26.. ..	4,143 ,,	27½–24½	4 p.m.–8 a.m.
,, 28.. ..		22½	8 a.m.
,, 29.. ..		20½	8 a.m.

i.e., 2 lb. per sq.in. drop per 24 hours during last day. All joints in above section proved tight on test. The trouble must therefore have been in part laid from June 14 to 26. A re-test of the joints in this section did not reveal any leakage. The leakage could not be detected by noise of escape.

The remainder of the section, 8,747 ft. in all, was laid. A re-test gave the following results:

2. Date.	Time.	Pressure.
Oct. 18	7.30 p.m.	16 lb./sq.in. on gauge
,, 19	7.30 a.m.	15⅔ ,, ,, ,,
,, 21	2.30 p.m.	14 ,, ,, ,,
,, 22	9 a.m.	13½ ,, ,, ,,
	85½ hr.	2½ lb./sq.in.

The extent of the leakage in these two cases is:

1. Capacity of 4,143 ft. of 15 in. main = 5,030 cu.ft.
   at 24½ lb./sq.in. = $\frac{24.5 + 15}{15} \times 5{,}030 = 13{,}400$ cu.ft.
   at 22½ lb./sq.in. = $\frac{22.5 + 15}{15} \times 5{,}080 = 12{,}700$ cu.ft.
   2 lb./sq.in. in 24 hr. = 700 cu.ft. loss = 29 cu.ft. per day
2. Capacity of 8,747 ft. of 15 in. main = 10,730 cu.ft.
   at 16 lb./sq.in. = $\frac{16 + 15}{15} \times 10{,}730 = 22{,}200$ cu.ft.
   at 13½ lb./sq.in. = $\frac{13.5 + 15}{15} \times 10{,}730 = 20{,}400$ cu.ft.
   2½ lb./sq.in. in 85½ hr. = 1,800 cu.ft. loss = 21 cu.ft. per day

This leakage was ultimately discovered, after gas had been introduced to the main, by the smell of escaping gas and discoloration of the grass below which it was laid. A small split in the body of the steel main under the hessian and bitumen wrapping was the cause. From these observations it will be realized that, to detect even a relatively large leakage such as the one instanced, it is necessary to maintain the test for at least 12 hours if a measurable pressure drop on the gauge has to be observed. Also, that unless the gauge is reliable to within ½ lb. per sq.in. its function as a leakage detector is impaired. The actual leakage is proportional to the absolute pressure applied, and so leakages are more easily detected at higher pressures.

Location of Leakages by Ethyl Mercaptan.

Since experiencing the above trouble in locating small leakages during laying, when it is not desirable to introduce coal gas, we have successfully used ethyl mercaptan (C_2H_5SH).

This is a volatile liquid which on being poured into the main and the pressure applied, changes into a gaseous state and is diffused throughout the length of the main. The leakage in the main allows the pungent smell of the ethyl mercaptan to escape and so the place of leakage is easily found.

Clearing Mains.

A simple and effective method of ensuring that there are no obstructions left in the section of main which has just been laid is to knock off the cast iron cap which has been put on the end of the main for testing when there is 10 to 15 lb. per sq.in. pressure still in the main, first ascertaining that no men or material are in the way of the air blast. This sudden release of pressure causes a high velocity of air to travel along the main bringing with it rust, dust, and any other matter lying in the main. The removal of these matters may avoid future troubles with governor and valve seats, small burners, &c.

Welding of Mains.

The welding of the mains may be done in the trench or above the trench, both having advantages. Where there are high winds which cool the weld, the protection of the trench is useful. Also where there is very little run on the main and where it is necessary to ensure that each pipe is in line with the other a more satisfactory job is done when the mains are laid in the track. On the other hand, welding on top is useful where joint holes would require to be dug in very hard

ground. Where small diameter mains are laid which have considerable flexibility, the main may be threaded into the track after welding on top.

Testing may be done on top or in track; if the latter, small clearance holes in the track for allowing application of the soapy water test must be made. This also ensures that the job is tight when laid in its final position and that the joints will not be strained during lowering into the track.

Where oxy-acetylene welding is used advantage can be taken of the utility of this process for the cutting and welding required in making branches *in situ*, mitring pipes to form bends for special circumstances, and converting side syphons to through syphons by using cut-off faucets as arms; also for welding boxes on mains for service connexions instead of boring and tapping and other items which occur during the progress of the work.

Crossing Main Roads.

A method which has been used successfully in crossing arterial roads without seriously interrupting traffic, and without any pipe joints in the roadway, consists of cutting a track halfway across the roadway just wide enough to allow the pipe in and a beater (with two flat sides to keep as narrow as practicable on either side). The road surface on either side of the track is removed to allow half-length sleepers to be laid with their top surface flush with the road surface. This will allow heavy fast traffic to pass without interruption while the other half of road is opened for the pipe. The main is threaded through below the sleepers, the one half filled in and preferably beaten tight with a mechanical beater to ensure it standing up to the traffic. After the one half is filled in, the sleepers are removed and this half filled in. By using a length of main sufficient to span the width of the roadway, no future trouble will be experienced with joint leakage.

Recording Work Done.

In order that future reference may be made to the main which is being laid it is essential that a record be kept of the position of the main, expansion joints, valves and joints, &c. This is most important where the track is laid in virgin ground which may ultimately be used for town-planning or otherwise altered. The general practice in main laying is to keep a written description of the work, together with an ordnance plan on which the position is marked.

In addition to the usual description, I have made it a practice to mark the position of all joints by an arrow on the kerbstone or wall so that any leakage may be easily located. Further, at intervals the actual distance of main is chiselled on the kerb or wall. Syphons, valves, and expansion joints are distinctively marked.

Where the main is laid in the open country and marking points are liable to be obliterated or covered by snow, concrete posts are used. They indicate that the post refers to Gas, give the size of main, nature (*i.e.*, high pressure), indicate whether expansion joint (E.J.), syphon (S), or valve (V), and the distance that these fittings are from the post. Further to ensure easy location of any part of the job, a detail of each pipe length, with side references as to location of branches, specials, road crossings, with cover and change of fall, has been compiled. Thus from these sizes and the marked position on the job any particular joint, &c., can be found.

Personnel.

The choice of workmen is of vital importance to the success of any job and reliable foremen can effect considerable savings if able to get the best out of their men. Approximately one-third of the cost of mainlaying goes in wages. This in turn means employing men of ability and suitable physique, which in these days of long terms of unemployment is not always easy to follow. But on large scale work the placing of each man to the type of work to which he is best suited will help to get over this difficulty. Many men are perfectly willing to put in an honest day's work but through lack of nourishment during enforced idleness have lost their stamina. Careful handling of such men can bring them to be very useful in a squad, and a few weeks' work and pay, with the fresh air, can work a wonderful transformation, both physical and mental. On the other hand, it is not difficult to spot the slacker and dodger, who should be got rid of before spoiling the rest of his mates. By noting particularly good men, these may be incorporated in the regular mainlaying squads, as required. A knowledge of this fact will encourage honest men to give of their best.

Time Schedule for Work.

I have tried out two time schedules for working an 8½-hour day, the hours of work and mealtimes being:

Hours.	Work.	Meals.
	Hr. Min.	Hr. Min.
(*a*) 7.30 a.m.–12 midday	4 30	—
12–12.30 p.m.	—	0 30
12.30–4.30	4 0	—
	8 30	0 30
(*b*) 7.20–9 a.m.	1 40	—
9–9.20 a.m.	—	0 20
9.20–12.30 p.m.	3 10	—
12.30–12.50	—	0 20
12.50– 4.30	3 40	—
	8 30	0 40

Of these two schedules, I find the second has many advantages. The average workman does not appear to be able to take a substantial breakfast before leaving the house in the early morning. By dividing the day with two meal periods and thus reducing the times of continuous work, the vitality is renewed and the monotony of labour broken. In the heat of summer the rest is appreciated and in the cold winter the stimulating effect of a meal with tea renews the energies.

The average man does not object to an early start but is always keen on finishing early. Where train, tram, or bus times demand, the times may be varied to suit. Also the dinner hour may be advanced from 12.30 to 1 p.m. thus putting the long spell in the forenoon when the men are more fresh. With a 47-hour week and using the same morning timetable the stop will be at 12.10 p.m. on Saturday.

"Gasifying" the Main.

When the main has been completed it requires to be "gasified." To do this effectively and expeditiously over a number of miles we have found it convenient to erect a number of 2 in. stand pipes at a point remote from the source of gas pressure which is used to expel the air. If a sampling cock is fitted on the stand pipes near ground level samples may be taken, when the gas has come forward, and tested for oxygen content, to ensure that no air enters the gas supply. Syphon pumping tubes may be used to check up the progress of the gas along the new main. They will, of course, be used to pump out any water which may have entered the main during laying.

Analysis of the Costs of Mainlaying.

There are a number of points which directly influence the costs of mainlaying and these are shown by a study of the following table which has been compiled from observations kept during normal main extensions. So that each job may be comparable, I have selected the laying of 4 in. cast iron spigot and faucet pipes and converted each job to the number of feet laid per man per week. The work was done by similar squads and in a number of cases by the same men, so that the influence on the rate of progress is other than personal.

No.	Length.	Main Laid.	Nature of Ground, &c.
A ..	225 yd.	36 ft./man/week	Virgin ground
B ..	286 ,,	35 ,, ,,	,, ,,
C ..	223 ,,	33 ,, ,,	Old cart track
D ..	150 ,,	28 ,, ,,	Ash pavement. Number of specials
E ..	274 ,,	27 ,, ,,	Virgin, very wet
F ..	102 ,,	21·5 ,, ,,	Virgin, hold up
G ..	205 ,,	13·5 ,, ,,	Hard road and rock

The influence on the rate of laying and therefore final costs due to the nature of the ground are seen. Job G costs more than double the first three, which are in easily excavated ground. Very wet conditions in the track are responsible for the slowness of E compared with the first three. During Job F a hold-up occurred while awaiting a contractor's line and levels of a new roadway; also the shortness of Jobs D

and F reduce the progress due to time required in settling down.

The following table gives the proportional cost per yard in mainlaying from a number of jobs of very different natures:

Lead Run Joints.

——	4 In. C.I.			6 In. C.I.			9 In. Steel.		
	s.	d.	%	s.	d.	%	s.	d.	%
Labour	6	0	55·8	6	9	51·9	9	11	38·0
Materials	4	6	41·9	6	2	47·4	15	5	60·0
Cartage	0	3	2·3	0	1	0·7	0	6	2·0
Total	10	9	100	13	0	100	25	10	100
Length (yd.)	227			383			287		
Delivery capacity	32			88			243		

Welded Joints.

——	9 In. Steel.			15 In. Steel.			Stanton-Wilson 15 In. C.I.		
	s.	d.	%	s.	d.	%	s.	d.	%
Labour	7	9	35·3	12	8	24·2	21	6	46·2
Materials	12	10	58·0	37	4	71·0	25	0	53·8
Welding	1	1	4·7	1	10	3·5	—		
Cartage	0	5	2·0	0	8	1·3	—		
Total	22	1	100	52	6	100	46	6	100
Length (yd.)	10,666			3,043			652		
Delivery capacity	243			871			871		

The costs of travelling and reinstating track surfaces have been omitted as these conditions do not necessarily apply to all cases and for costing purposes can be estimated fairly closely. From the table it is evident that a 9 in. steel main can be laid as cheaply as a lead run-jointed steel main. Also that a 15 in. C.I. main with Stanton-Wilson joints could be laid at a very much cheaper rate than a 15 in. welded steel main.

It will be seen how the proportional cost of labour falls as the size of main increases.

Discussion.

Mr. W. N. BAIRD (Dunfermline) said that when one considered that 30% of the cost of mainlaying was due to wages, and the job might cost thousands of pounds, it would appear that there was room for some really efficient pipe-handling machine, which, if costly, could be hired out among a number of Undertakings.

Mr. Rea had mentioned the necessity of valves in his scheme, and he would like to know which type of valve he used. His experience had been that the sliding face type was no use at all after being in the ground for some time, and recently he had changed some of these for Audley valves with external gearing. These bound-to in time, but they could be easily released by forcing in enough lubricant. A much superior idea was that recently described in an article on "Bagging-off Large Gas Mains in an Emergency" by Mr. R. G. Marsh, of the Birmingham Gas Department, which had appeared in the "JOURNAL" for Nov. 16.

In regard to the question of pressure testing a main after it was laid, it seemed to him to be equally important that facilities for repeating those tests at intervals of every year or so should be made. In this way pipe maintenance could be put on a scientific basis.

On the question of gasifying the main, samples were taken to find the oxygen content. He thought this to be needlessly laborious and costly and thought it would be just as effective to burn the mixture after passing it through a fine wire mesh. If there was any doubt about the principles of the Davey lamp holding good, then small samples could be taken off in bladders and the contents tested by a light away from any source of danger.

An interesting point raised by Woodall and Parkinson with regard to the choice of cast iron or steel was that it had been found that the pitting due to corrosion seldom extended to a greater depth than ¼ in. As the allowable tensile strength for cast iron pipe was only 2 tons per sq.in. against 6 tons per sq.in. for steel, it followed that theoretically ¼ in. thickness of a steel pipe was equivalent to 1 in. cast iron pipe. Taking pipes of these thicknesses corroded by pitting to the extent of ¼ in. deep the loss in strength of the cast iron pipe is 12% against 40% with steel. This meant that the economic bearing of corrosion on the use of steel pipes was of more importance than it was with cast iron pipes.

He asked Mr. Rea if he had any scientific reasons which dictated the number of syphons and their position, apart from the obvious ones of rise and fall of ground level. It was his experience that in high pressure work condensation took place within one or two hundred yards of the compressor and thereafter was almost unknown. From this point of view he would be inclined to lay cast iron pipe from the works for some distance. During the recent crisis he had seen at least one very useful mechanical trenching machine in action. He would have thought that one of these would have been of great advantage to a large undertaking like Edinburgh, particularly when they were breaking virgin soil.

Mr. F. B. WALLER (Alloa) thought that a very careful survey of the ground before commencing was most important and strict attention should be paid to the likelihood of any underground workings or likely subsidences in the area through which the pipe would pass.

Mr. J. WILSON (Dundee) said they were trying out asbestos cement pipes at Dundee. He would be charry about using welded joints in a mining area; owing to the dangers of subsidence, it was better to use long-sleeve joints and allow for drawing.

Mr. REA, replying, said he agreed with the point raised about valves. He had never been satisfied with the design of valves, but agreed that the type mentioned were an improvement. He thought that it was better to test for gas with an Orsat when gasifying a main; it was more precise. Corrosion was the great bugbear with steel, and he agreed with Mr. Baird in his remarks on this. The syphons used on the job had been placed at the low parts of the main; he agreed that most of the water condensed out at the outlet of the compressor. The use of a mechanical excavator led to trouble with other people's property, as it took everything before it—pipes, drains, &c.

Mr. Therm Sees It Through

Cold Spell Met with Record Outputs

"Oh, Mr. Mercury! You did give me a start," Mr. Therm might well have said during the recent cold spell, when with every degree fall in the thermometer gas sales leapt until they attained figures never before achieved. It stands enormously to the credit of the Industry that these tremendous abnormal outputs were met without loss of pressure, or deterioration of quality. Engineers all over the country pay unstinted tribute to their staffs and employees for the gigantic efforts with which they met the great task of catering for such a demand, but surely they themselves are deserving of the highest praise for having directed the affairs of their Undertakings with such foresight and for their own untiring vigilance and hard work during the cold spell. Here are brief reports from various quarters:

Bristol.—For the seven days ended Christmas Day, 128,444,000 cu.ft. were consumed. Record-breaking began on Monday, Dec. 19, when the day's consumption, 19,508,000 cu.ft., was 1,769,000 cu.ft., or 10%, more than the existing record day. On each of the three succeeding days the old record was well beaten. Christmas Day set up a new record for Sunday consumption with a figure of 17,484,000; this was 624,000 cu.ft. higher than the previous record, an increase of 3·7%. Excellent publicity was given to the successful manner in which the Bristol Gas Company coped with these records in both the *Evening World* and *Western Daily Press*.

Coventry.—A record week ended Dec. 20, when 72¼ million cu.ft. were sold. Of this quantity 12½ million cu.ft. was supplied on Dec. 19, 1,007,000 cu.ft. being consumed between the hours of 8 a.m. and 9 a.m. on that day.

Eastbourne.—All records in eighty-six years' history of the Company were broken. On Christmas Day the output totalled 2,898,000 cu.ft., a quarter of a million cu.ft. more than the previous record set up in 1929. During the cold spell the Company had to produce 50% more gas. By noon on Dec. 19 the output was 2,648,000 cu.ft. The records were feature front page news in the *Eastbourne Herald*.

East Wight.—Sandown, Shanklin, and Ventnor required 5 million cu.ft. from the East Wight Gas Company during the week ended Christmas Day, on which day the output exceeded by 25% any previous Christmas. The demand on the Shanklin Works of the Company increased by 85%. The *Isle of Wight Chronicle* gave excellent publicity to this fine achievement.

Pudsey.—Output in the twenty-four hours to 6 a.m. on Dec. 22 was 926,000 cu.ft., an increase of 149,000 cu.ft., or almost 20% the previous year's maximum day.

Tipton.—Record day leapt on Dec. 20 from 1,355,000 cu.ft. to 1,713,000 cu.ft., an increase of 26·4%.

Watford and St. Albans.—"Little Man, You've Had a Busy Week" ran an advertisement, the layout and copy for which were completed well within an hour, inserted in the *Herts. Advertiser* by the Watford and St. Albans Gas Company, who on Dec. 20 sold over 9 million cu.ft of gas This was an increase of over 20% on the previous best day and 50% higher than the previous Saturday, Dec. 17. The copy was written so as not to "knock" too obviously at the electricity undertakings, who had several minor break-downs in this area.

It is related that there was, in ancient times, a young man who had married the daughter of a renowned worker in metals and who aspired to surpass his father-in-law in his Craft. So he journeyed to distant lands, and at length he found the true Philosopher's Stone with which he produced much gold and made objects therefrom.

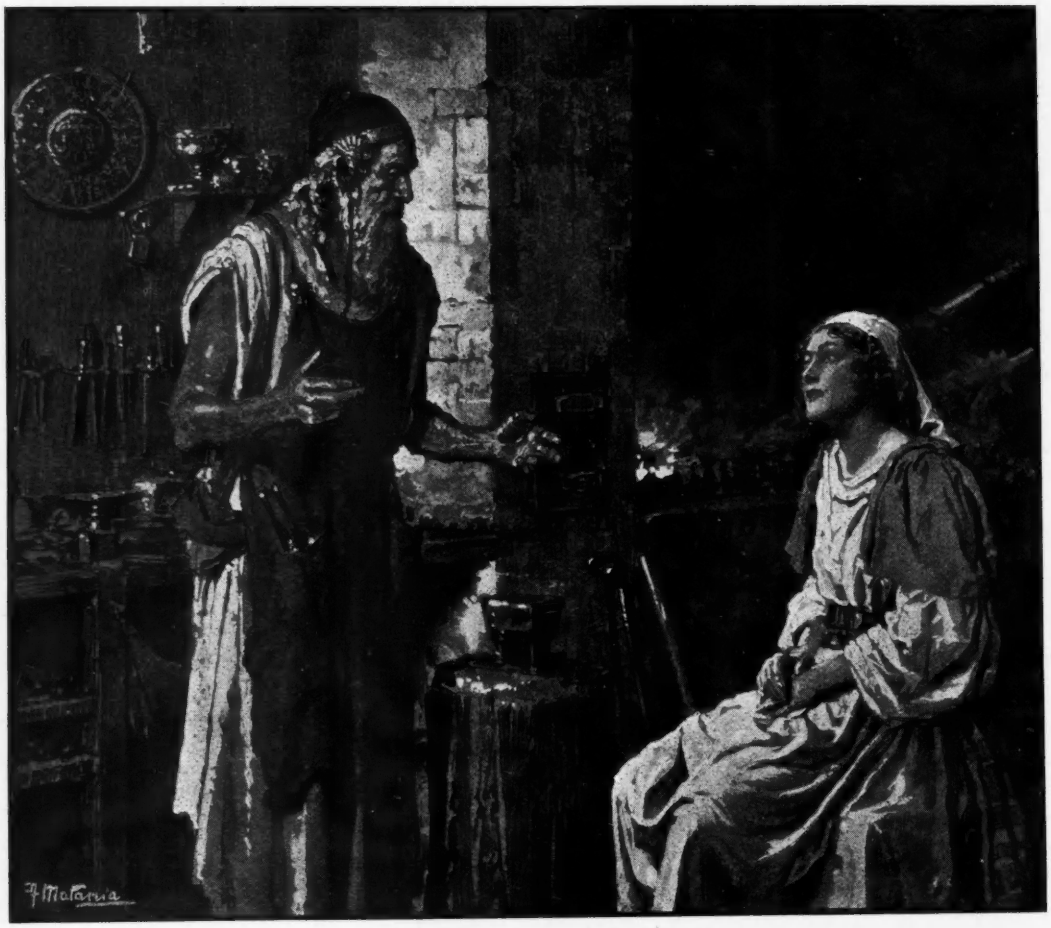
But, alas! he could sell them for little more than the value of the gold, whereas the older man, though he had to buy his gold, made objects of a perfection almost beyond price.

Sorely troubled by this, the young wife visited her father secretly to ask the wherefore.

"Ah, my daughter," her father exclaimed, "tell your husband that he has forgotten the one thing more precious than gold."

"And what is that?" asked the girl.

"It is Craftsmanship, my daughter, which cannot be lost, stolen or transmuted, and whose value cannot be weighed in the mightiest scale in the world."



As modern as to-morrow, but with the knowledge and experience of 144 years, Newton Chambers & Co., Ltd., specialise in the manufacture of Blast Furnace Plant, Gas Works Plant, Steel Works Plant, General Chemical Plant, Benzole Plant, By-Product Plant, Cast Iron Tanks, Steel Tanks, Coke Oven Machinery, Pig Iron, Excavators, Economisers, Air Heaters, Recuperators, General Castings for the various trades and all forms of Light Castings.

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Athletic and Social

Cochran's Dinner and Dance.

A company of 230 attended a dinner and dance held by the staff of Messrs. Cochran & Co., Newbie Engineering Works, Annan, on Dec. 16. Mr. Charles E. Crompton, Chairman of the firm, presided, the speakers including Mr. R. R. Stokes, M.P., Managing Director, and Mr. P. S. Drew, Estimating Manager.

Wolverhampton Retirements Marked.

Five members of the Wolverhampton Gas Company who retired at the end of last month were recently presented with either a watch or a clock.

Presentations were made by Mr. A. H. Cranmer, Chief Engineer, and Mr. A. G. Williams, Commercial Manager and Secretary. Both remarked upon the loyalty of the men who were retiring. Mr. Cranmer said that over 45 men were receiving pensions from the Company, 3 of them being over 80 and 9 over 75. A. Harrison, 53 years' service; J. Underwood, 50 years; and T. Scriven, 27 years, received clocks, and J. R. Baker, 43 years, and J. Collins, 30 years, had watches.

Leamington Sports and Social Club.

A large and enthusiastic gathering of nearly 100 members attended the Annual Supper and Smoking Concert of the Leamington Gas Sports and Social Club held at the Great Western Hotel, Leamington. Mr. R. S. Ramsden (Director, General Manager, and Engineer), who is President of the Club, presided, being supported by Alderman C. H. Southorn, J.P. (Vice-Chairman of the Company), and Mr. W. H. Reed (Engineer and Manager of the Warwick Gas Company), Vice-Presidents; Mr. F. A. Jenkins (Assistant Engineer, Leamington), and Mr. H. Broadbridge (Hon. Secretary of the Club), with Mr. I. S. Prater (Hon. Treasurer).

The Chairman said they were honoured that evening by the presence of two of their Vice-Presidents, Alderman Southorn and Mr. Reed. He pointed out that their Club was an amalgamation of several clubs which had been carried on among the employees of the Company for several years. The membership was now close on 150, representing nearly three-quarters of their employees. The work of the Club was carried out by a Committee, of which Mr. Jenkins was Chairman and Mr. Broadbridge Hon. Secretary. He took that opportunity of expressing, on behalf of all present, their deep sense of loss at knowing that Mr. Broadbridge was leaving them, and their hearty congratulations on his new appointment as General Manager and Engineer of the Andover Lighting and Power Company.

Alderman Southorn then presented the Bowls Championship Cup to Mr. G. W. Dymond; the Snooker Challenge Cup to Mr. J. Williams; and the Departmental Swimming Cup to a representative of the Yard Department team.

The Main Seam, North Wales

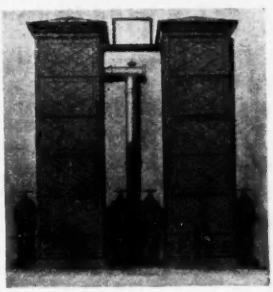
With the publication of a report* on the main seam of the North Wales coalfield, the Department of Scientific and Industrial Research presents the 45th report of the series dealing with the physical and chemical survey of the national coal resources, and adds a new field to those already covered by these Papers.

The work of the Survey in North Wales is carried on from the laboratory in Stoke-on-Trent, under the supervision of Dr. J. O'N. Millott, the Department's senior officer in the area. The main seam was selected as the first for systematic examination upon the advice of the local survey committee, representing the North Wales coal owners and the Department.

The main seam (in places known as the Five Yard or Six Foot) occurs in both the Flintshire and Denbighshire areas and is of such importance that the extent and distribution of mining has everywhere been largely determined by its availability. In Flintshire, denudation, acting on folded and much faulted strata, has greatly restricted the area in which this seam is present, and it is partly for this reason, and partly owing to the depletion of the reserves of other profitable seams, that active working in this area has declined markedly in recent years.

In the northern part of the Denbighshire area, where the seam attains its greatest commercial importance, the larger sizes provide a good household, manufacturing, and steam coal, while the smaller sizes, owing to a high gas yield and good caking properties, are extensively sold for gas manufacture. In the southern part of the Denbighshire area the seam yields a valuable gas-making and industrial coal.

* Fuel Research Survey Paper No. 45—The North Wales Coalfield—The Main Seam. Published by H.M. Stationery Office, price 2s. net.



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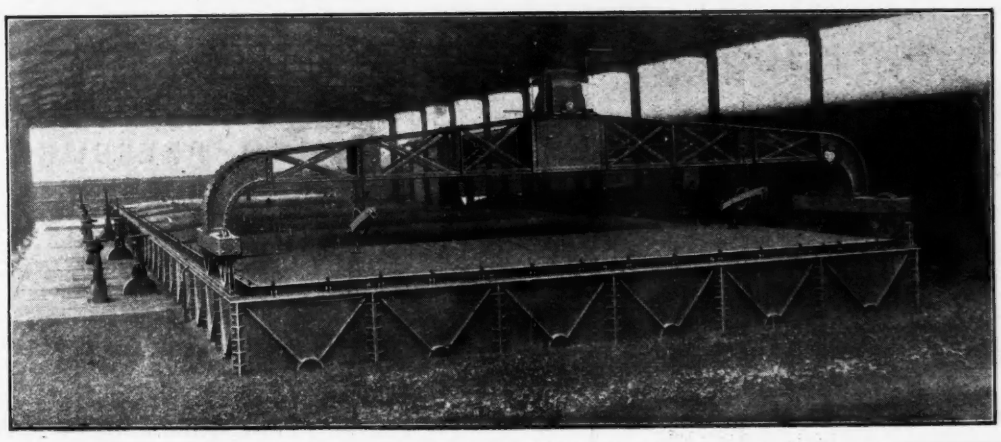

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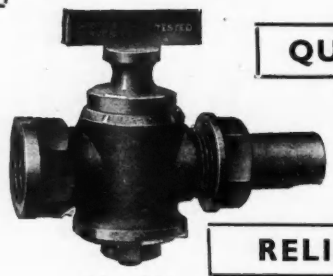

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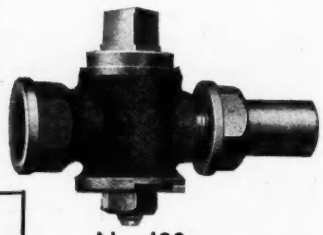

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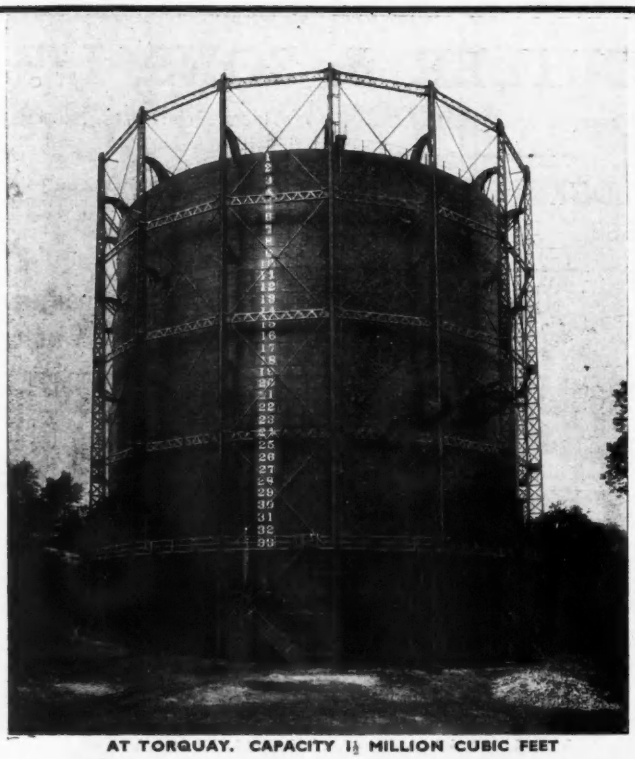

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Markets and Manufactures

Current Sales of Gas Products

The London Market

Jan. 2.

Current values of Tar Products in the London market are as under:

Pitch, nominal at about 30s. per ton f.o.b.
Creosote, about 3¾d. to 4d.
Refined tar, 3¾d.
Pure toluole, about 2s. 3d.
Pure benzole, about 1s. 9d.
95/160 solvent naphtha, 1s. 7d. to 1s. 8d.
90/160 pyridine, 10s.
All per gallon naked at makers' works.

The Provinces

Jan. 2.

Crude Gas-Works Tar, 14s. to 19s.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 29s. to 30s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 29s. to 30s.* Toluole, naked, North, 1s. 7½d. to 1s. 9d. Coal tar, crude naphtha, in bulk, North, 7½d. to 8¼d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 5d. Heavy naphtha, North, 1s. 2¼d. to 1s. 3d. Creosote, *ex* works, in bulk, North, liquid and salty, 4⅛d. to 4⅜d.; low gravity, 4¼d. to 4½d. Carbolic acid, 60's, 1s. 7d. to 1s. 10d. Naphthalene, £13 10s. to £16. Salts, 70s. to 75s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal; "B" quality unsaleable. Heavy oil; Unfiltered anthracene oil, min. gr. 1,080, 4¾d. to 4⅞d.; filtered anthracene oil, min. gr. 1,080, 5¼d. to 5½d.; heavy tar oil, gr. less than 1,080, 4¼d. to 4½d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Scotland

GLASGOW, *Dec.* 31.

The year closes with prices of all products rather unstable.

Crude gas-works tar.—Actual value is about 35s. to 36s. per ton *ex* works in bulk.

Pitch remains weak at 21s. to 22s. per ton f.o.b. for export and round 20s. per ton *ex* works for the home market.

Refined tar.—Home price is maintained at 3¼d. to 4d. per gallon, while for export supplies can be secured at round 2¾d. to 3d. per gallon, both into buyers' packages at makers' works.

Creosote oil.—Market is quiet with makers' prices unchanged as follows: Specification oil, 3¼d. to 4d. per gallon; low gravity, 4¼d. to 4½d. per gallon; neutral oil, 3¾d. to 4¼d. per gallon; all *ex* works in bulk.

Cresylic acid.—Values are nominal as follows: Pale, 97/99%, 1s. 2d. to 1s. 3d. per gallon; dark, 97/99%, 1s. to 1s. 1d. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 7d. per gallon; all according to quality *ex* works in buyers' packages.

Crude naphtha is commanding 5½d. to 6d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha.—90/160 grade is 1s. 3½d. to 1s. 4d. per gallon and 90/190 heavy naphtha is round 1s. 1d. to 1s. 1½d. per gallon.

Motor benzole is 1s. 3d. to 1s. 4d. per gallon.

Pyridine.—90/160 grade is 8s. to 9s. per gallon and 90/140 grade is 9s. to 10s. per gallon.

Benzole Prices

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole..	0	9½	to	0	10	per gall. at works
Motor „ ..	1	3	„	1	3½	„ „ „
90% „ ..	1	4	„	1	4½	„ „ „
Pure „ ..	1	8	„	1	8½	„ „ „

Contracts Advertised To-Day

Coal.
City of Salford. [p. 70.]

Exhausting Plant.
Tipton Gas Department. [p. 70.]

Gasholder.
Tipton Gas Department. [p. 70.]

Meters.
City of Salford. [p. 70.]

Repairs to Gasholder Framework.
Mansfield Gas Department. [p. 70.]

Stores.
Blackpool Corporation. [p. 70.]
City of Salford. [p. 70.]

Static Washer.
Tipton Gas Department. [p. 70.]

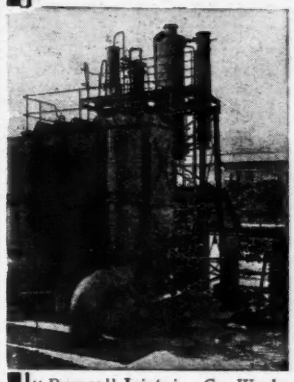
Tar Extractor.
Tipton Gas Department. [p. 70.]

Diaries, Calendars, &c., Received

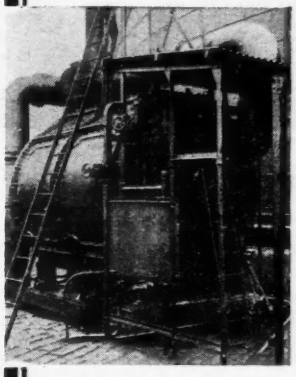
Seasonable gifts in the form of diaries, calendars, &c., have been received from the undermentioned friends, whose good wishes are cordially reciprocated:

Brotherton & Co., Ltd., Leeds.
R. & J. Dempster, Ltd., Manchester.
Gale & Polden, Ltd., Argyll Street, W. 1.
W. C. Holmes & Co., Ltd., Huddersfield.
Simon-Carves, Ltd., Cheadle Heath.
Stanton Ironworks Company, Ltd., Nr. Nottingham.
Wood, Rozelaar, & Wilkes, Ltd., North Acton Road, N.W. 10.

25 Years' Hard!



"Permac" Joints in a Gas Works.



"Permac" Joints in a Gas Works.

Ever since 1913 "PERMAC," the original Metal-to-Metal Jointing, has been holding up difficult joints like these in important Gas Works and on Coke Oven Plants all over the world. Equally suitable for any joint—steam, water, gas, oil—screw pipe or flange.

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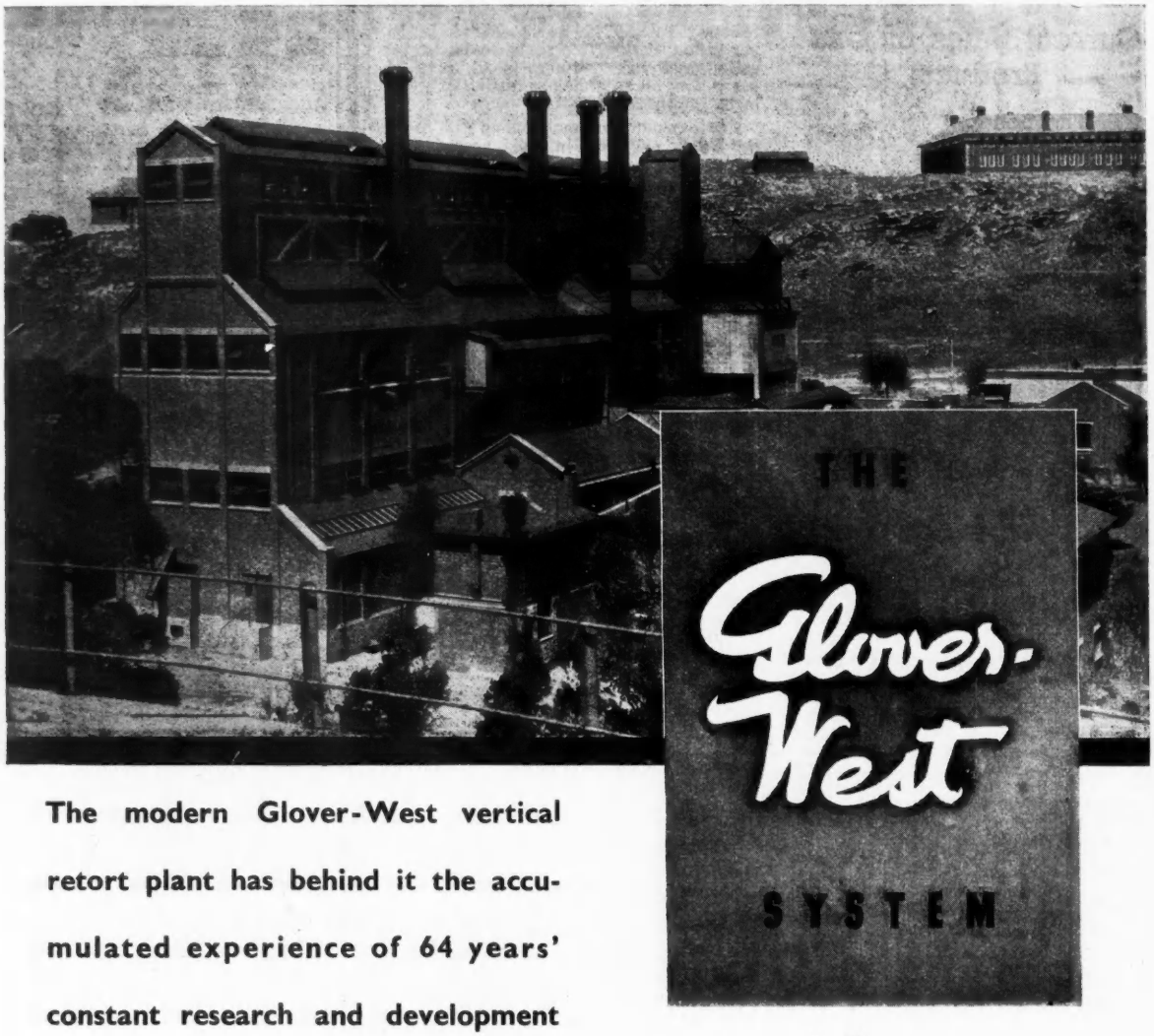
● CARBONIZATION IN VERTICAL RETORTS



The modern Glover-West vertical retort plant has behind it the accumulated experience of 64 years' constant research and development for the advancement of gas production methods the world over.

● *430 plants have been built or are on order for 230 Gas Undertakings in 24 countries.*

The picture shows the three installations of Glover-West vertical retorts at Johannesburg City Council's Cottesloe gasworks. The carbonising unit of the complete modern gasworks ordered for Johannesburg from this company in 1926 has been trebled to meet the rapid growth of demand. The latest extension put to work in 1937 is nearest the camera.

●

WEST'S GAS IMPROVEMENT CO. LTD.,

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GAS STOCKS AND SHARES

The Stock Exchange opened quietly after the holidays and, although there was not much business done during the three days, prices were well maintained and the year closed on a confident tone. More support was given to British Government stocks and the strength of these and other high-class securities was partly attributable to the hopes of more business accruing after the large dividend disbursements at this time of the year. A little more life was noticeable in the home rail market towards the close and a few fractional improvements were recorded. Industrials remained firm, with iron and steel and aircraft shares continuing the favourites. Rubber shares received a stimulus on a rise in the price of the commodity, and leading oil shares also displayed strength on Friday.

Gas stocks and shares were comparatively well supported and prices remained firm with few changes either way. The only alteration of note in the Official List was a rise of 3 points in Imperial Continental to 113½. At the time of writing there is a parcel of £500 of this stock available at 115 to yield £8 12s. 10d.%, and with the continuance of more settled conditions in France some further appreciation in value should materialize. Apart from *ex div.* markings, the only alterations on the Provincial Exchanges occurred in Newcastle units with a gain of 3d. to 23s., or 6d. higher than in London, and a drop of 1 in Sheffield Consolidated to 140. In the Supplementary List the nominal quotation of Hampton Court consolidated fell 5 to 128½, and South Midland Gas Corporation ordinary and preference shares both weakened.

At the present time the list of preference stocks and shares available is fairly comprehensive, and although the average yield of these securities is now round about 4½%, there are several parcels on offer giving a higher return which should provide satisfactory permanent investments. Among these are the following: £50,000 British Gas 5½% cumulative at 115 free yielding (gross) £4 15s. 7d.%. This stock is redeemable in 1967 at 105 and the dividend, payable in January and July, accrues from the 3rd of this month. A small parcel of Eastbourne 5% is offered at 107 to yield £4 13s. 6d.%. Severn Valley £1 4½% cumulative preference shares, of which 5,000 are available at 21s. free, give a return of £4 5s. 8d.%, and a small lot of Tottenham 5% at 112 yields £4 9s.%.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 30.	Rise or Fall on Week.
1,767,439	Sept. 5	8	8	Alliance & Dublin Ord. ...	130—140	...
374,000	Dec. 19	4	4	Do. 4 p.c. Deb. ...	93—98*	...
734,733	Nov. 7	5	5	Asscd. Gas & Water U'd'ts Ord.	17/—19/–	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/—21/–	...
444,389	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	19/—21/–	...
296,523	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	16/—18/–	...
500,000	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
560,070	Aug. 22	7	7	Barnet Ord. 7 p.c.	158—162	...
300,000	Oct. 10	1/9½	1/4½	Bombay, Ltd.	24/—26/–	...
180,435	Aug. 22	9½	9½	Bournemouth sliding scale ...	195—205	...
640,407	,,	7	7	Do. 7 p.c. max. ...	157—162	...
495,960	,,	6	6	Do. 6 p.c. Pref. ...	130—135	...
50,000	Dec. 19	3	3	Do. 3 p.c. Deb. ...	75—80*	...
312,025	,,	4	4	Do. 4 p.c. Deb. ...	96—102*	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	113—118*	...
357,900	Aug. 8	7½	7½	Brighton, &c., 6 p.c. Con. ...	142—147	...
659,955	,,	6½	6½	Do. 5 p.c. Con. ...	126—131	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref. ...	125—130	...
855,000	Sept. 19	8	7	British Ord.	133—138	...
100,000	Dec. 19	7	7	Do. 7 p.c. Pref.	138—143*	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	112—117*	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
450,000	,,	5	5	Do. 5 p.c. Red. Deb. ...	100—105*	...
450,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95*	...
100,000	22May'33	6	4	Cape Town, Ltd.	1—2	...
100,000	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1—2	...
150,000	Dec. 19	4½	4½	Do. 4½ p.c. Deb. ...	60—70*	...
626,860	July 18	6	6	Cardiff Con. Ord.	118—123	...
237,860	Dec. 19	5	5	Do. 5 p.c. Red. Deb. ...	103—108*	...
98,936	Sept. 19	2/–	2/–	Colombo Ord.	1⅞—1⅞	...
24,510	,,	1/4½	1/4½	Do. 7 p.c. Pref. ...	22/6—24/6	...
739,453	Oct. 10	–/11·48	–/11·48	Colonial Gas Assn. Ltd. Ord.	16/6—18/6	...
296,144	,,	1/3·30	1/3·30	Do. 8 p.c. Pref. ...	23/6—25/6	...
1,775,005	Aug. 8	5	5	Commercial Ord.	77—82	...
140,000	,,	—	§13/4	Do. 4 p.c. Red. Pref. ...	95—100	...
620,000	Dec. 5	3	3	Do. 3 p.c. Deb. ...	71—76	...
286,344	Aug. 22	5	5	Do. 5 p.c. Deb. ...	113—118	...
200,000	,,	—	§30/2	Do. 3½ p.c. Red. Deb. ...	97—102	...
807,560	Aug. 8	7	7	Croydon sliding scale ...	136—141	...
644,590	,,	5	5	Do. max. div.	100—105	...
620,385	Dec. 19	5	5	Do. 5 p.c. Deb. ...	112—117*	...
239,000	Aug. 8	5	5	East Hull Ord. 5 p.c.	95—100	...
186,155	Aug. 8	6	6	East Surrey Ord. 5 p.c. ...	116—121	...
176,211	Dec. 5	5	5	Do. 5 p.c. Deb ...	112—117	...
250,000	Nov. 7	8	4	Gas Consolidation Ord. 'B' ...	19/—21/–	...
250,000	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	17/6—19/6	...
9,223,324	Aug. 8	5⅔	5⅔	Gas Light & Coke Ord. ...	22/3—23/3*a*	...
2,600,000	,,	3½	3½	Do. 3½ p.c. max. ...	78—81	–1
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref. ...	98—101	...
2,993,000	July 4	—	3⅜	Do. 3⅜ p.c. Red. Pref. ...	98½—101½	...
8,602,497	Nov. 21	3	3	Do. 3 p.c. Con. Deb. ...	77—80	...
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb. ...	109—113	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	107—111	...
700,000	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
270,466	Aug. 22	6	6	Harrogate New Cons. ...	117—122	...
157,500	Mar. 21	1/2⅜	‡1/–	Hong Kong and China Ord. ...	⅜—⅞	–⅛
213,200	Aug. 8	6	5⅜	Hornsey Con. 3½ p.c. ...	97—102	...
5,600,000	Oct. 24	12	8	Imperial Continental Cap. ...	111—116	+3
223,130	July 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	87—92	...
235,242	Aug. 8	8½	8½	Lea Bridge 5 p.c. Ord. ...	160—165	...
63,480	Dec. 19	3	3	Maidstone 3 p.c. Deb. ...	69—74*	...
45,000	Nov. 21	†10	†10	Malta & Mediterranean ...	130—135	...
				Metropolitan (of Melbourne)		
392,000	Oct. 3	5½	5½	5½ p.c. Red. Deb.	100—105	...
231,977	Aug. 22	5	5	M.S. Utility 'C' Cons. ...	99—104	...
968,658	,,	4	4	Do. 4 p.c. Cons. Pref. ...	95—100	...
390,076	Dec. 19	4	4	M.S. Utility 4 p.c. Deb. ...	93—98*	...
148,955	,,	5	5	Do. 5 p.c. Deb. ...	112—117*	...
125,000	July 1	3½	3½	Do. 3½ p.c. Red. Bds.	95—98	...
675,000	Nov. 21	†6	†6	Montevideo, Ltd.	70—75	...
250,000	Aug. 8	7½	7½	North Middlesex 6 p.c. Con.	142—147	...
396,160	Aug. 8	5	5	Northampton 5 p.c. max. ...	105—110	...
300,000	Oct. 24	†7	†9	Oriental, Ltd.	145—150	...
468,537	Dec. 5	8	7½	Plymouth & Stonehouse 5 p.c.	135—145	...
621,667	Aug. 8	8½	8½	Portsmouth & Gosport Cons.	157—162	...
241,446	,,	5	5	Do. 5 p.c. max. ...	100—105	...
73,350	,,	5	5	Do. 5 p.c. Pref. ...	107—112	...
75,000	,,	4	4	Do. 4 p.c. Pref. ...	90—95	...
114,000	Aug. 8	5	5	Preston 5 p.c. Pref.	105—110	...
247,966	Dec. 19	4	4	Primitiva 4 p.c. Cons. Deb. ...	96—101*	...
625,959	July 18	4	4	Do. 4 p.c. Red. Deb.	94—99	...
15,000	Sept. 5	6	6	San Paulo 6 p.c. Cum. Pref. ...	8½—9	...
441,275	Sept. 19	1/1⅛	1/1⅛	Severn Val. Gas Cor. Ld. Ord.	20/6—22/6	...
460,810	Sept. 19	–/10⅝	–/10⅝	,, ,, 4½ p.c. Cum. Pref.	19/6—21/6	...
133,201	Aug. 22	5	8⅛	Shrewsbury 5 p.c. Ord. ...	143—148	...
9,000	June 3	4	‡4	South African Ord.	4½—5½	...
1,371,752	Aug. 22	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	21 —23 –	...
871,636	,,	–/10⅝	–/10⅝	Do. 4½ p.c. Red. Cum. Pref.	19 —21/–	...
498,818	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18 —20 –	...
450,000	Aug. 8	4	4	Do. 4 p.c. Deb.	99—102	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—97	...
6,709,895	Aug. 8	6	5	South Met. Ord.	103—106	...
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	128—133	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	95—100	...
1,895,445	Dec. 19	3	3	Do. 3 p.c. Deb.	74—79*	...
1,000,000	July 4	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...
600,000	,,	—	§31/–	Do. 3½ p.c. Red. Deb. ...	97—102	...
1,543,795	Aug. 8	6	6	South Suburban Ord. 5 p.c. ...	113—118	...
512,825	,,	5	5	Do. 5 p.c. Pref.	108—113	...
500,000	,,	4	4	Do. 4 p.c. Pref.	95—100	...
250,000	,,	3¾	3¾	Do. 3¾ p.c. Red. Pref. ...	92—97	...
888,587	Dec. 5	5	5	Do. 5 p.c. Deb.	113—118	...
250,000	,,	4	4	Do. 4 p.c. Deb.	95—100	...
200,000	Aug. 8	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—99	...
427,859	Sept. 19	8½	9⅓	S. Western Gas & Water Ord.	16/—18/–	...
160,523	Oct. 10	–/10⅝	–/10⅝	Do. 4½ p.c. Red. Cum. Pf.	19/—21/–	...
110,000	Dec. 19	4	4	Do. 4 p.c. Red. Deb. ...	93—98*	...
750,541	Aug. 8	5½	5	Southampton Ord. 5 p.c. ...	105—110	...
148,836	Dec. 19	4	4	Do. 4 p.c. Deb.	93—98*	...
350,000	Aug. 8	5⅓	5⅓	Swansea 5½ p.c. Red. Pref. ...	105—110	...
200,000	Dec. 19	3½	3½	Do. 3½ p.c. Red. Deb. ...	92—97*	...
1,076,490	Aug. 8	6½	6½	Tottenham and District Ord.	125—130	...
409,835	,,	5½	5½	Do. 5½ p.c. Pref.	116—121	...
62,235	,,	5	5	Do. 5 p.c. Pref.	108—113	...
334,615	Dec. 5	4	4	Do. 4 p.c. Deb.	95—100	...
85,701	Nov. 21	6	6	Tuscan 6 p.c. Red. Deb. ...	95—100	...
1,131,550	Aug. 22	6	4	U. Kingdom Gas Cor. Ord. ...	17/6—19/6	...
1,051,280	Nov. 7	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	19/—21/–	...
762,241	,,	4	4	Do. 4 p.c. 1st Red. Cum. Pf.	19/—21/–	...
745,263	Dec. 19	4½	4½	Do. 4½ p.c. 2ndNon-Cum.Pf.	15/6—17/6*	...
1,066,186	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—98	...
375,689	Aug. 8	7	7	Uxbridge, &c., 5 p.c. ...	125—130	...
133,010	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
1,371,138	Aug. 8	7	7	Wandsworth Consolidated ...	136—141	...
2,525,768	,,	4	4	Do. 4 p.c. Pref.	95—100	...
1,343,964	Dec. 19	5	5	Do. 5 p.c. Deb. ...	113—118*	...
383,745	,,	4	4	Do. 4 p.c. Deb. ...	95—100*	...
400,000	,,	§25/–	3⅜	Do. 3⅜ p.c. Red. Deb. ...	96—101*	...
558,342	Aug. 8	7	6⅔	Watford and St. Albans Ord.	128—133	...
200,000	,,	5	5	Do. 5 p.c. Pref. ...	107—112	...
200,000	,,	5½	5½	Do. 5½ p.c. Pref. ...	113—118	...
200,000	,,	—	16/8§	Do. 4 p.c. Red. Pref. ...	95—100	...
200,000	Dec. 19	4	4	Do. 4 p.c. Red. Deb. ...	95—100*	...
200,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	92—97*	...

a.—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Cont.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 30.	Rise or Fall on Week.
202,152	Sept. 5	5	5	Ascot Ord.	101—106	...
128,182	Dec. 19	5	5	Do. 5 p.c. Pref.	107—112*	...
31,035	Aug. 22	–/4½	–/4½	Associated Utilities 4 p.c. Pref.	16/—18/–	...
100,000	Dec. 19	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100*	...
17,000	Aug. 22	8	8	Bognor Orig. Ord. 'A' ...	155—165	...
62,210	,,	8	8	Do. New Addl. 'A' ...	155—165	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	145—155	...
37,440	Aug. 8	10	10	Cam. Univ. & Town 10 p.c. max.	188—198	...
125,970	,,	7	7	Do. 7 p.c. max.	133—138	...
39,025	,,	5	5	Do. 5 p.c. max.	97—102	...
96,410	July 18	4½	4½	Cardiff 4½ p.c. Pref.	95—100	...
150,000	Aug. 8	4	4	Croydon 4 p.c. Pref.	97—100	...
130,000	Dec. 19	4	4	Do. 4 p.c. Deb.	95—100*	...
65,000	Aug. 8	8½	7½	Eastbourne 'A' 5 p.c. ...	140—145	...
198,000	,,	7	6	Do. 'B' 3½ p.c.	114—119	...
112,312	,,	5	5	Do. 5 p.c. Pref.	107—112	...
130,000	Dec. 19	5	5	Do. 5 p.c. Deb.	110—115*	...
24,000	Aug. 8	8½	8½	Great Yarmouth 8½ p.c. max.	43—48	...
59,400	,,	7½	7½	Do. 7½ p.c. max.	33—38	...
51,160	Dec. 5	5½	5½	Do. 5½ p.c. Deb.	120—125	...
152,600	Sept. 5	9	8	Guildford Cons.	163—168	...
54,055	,,	5	5	Do. 5 p.c. Pref.	107—112	...
68,250	Dec. 19	5	5	Do. 5 p.c. Deb.	110—115*	...
156,600	Aug. 22	7½	7½	Hampton Court Cons. ...	126—131	—5
80,000	Aug. 8	4	4	Lea Bridge 4 p.c. Pref.	90—95	...
60,000	,,	6	6	Do. 6 p.c. Pref.	121—126	...
94,876	Dec. 5	4	4	Do. 4 p.c. Deb.	94—99	...
73,620	Sept. 5	8½	8½	Luton Cons. 'A'	153—163	...
107,960	Sept. 19	5½	4	Mid Kent Ord.	8½—9½	...
230,940	Aug. 8	10	10	Oxford & District Ord. ...	195—200	...
47,112	,,	5	5	Do. 5 p.c. Pref.	106—111	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	107—112	...
126,193	Nov. 7	7½	7½	Peterborough Ord.	137—142	...
64,990	Sept. 5	6½	7½	Redditch Ord.	118—128	...
166,850	Aug. 8	8	8	Romford Ord.	142—147	...
60,000	,,	4	4	Do. 4 p.c. Pref.	99—103	...
44,000	Sept. 19	5	5	Do. 5 p.c. Deb.	112—117	...
25,570	Aug. 8	5½	5½	Rugby 5½ p.c. Pref.	120—125	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	104—109	...
42,750	Dec. 5	5½	5½	Do. 5½ p.c. Deb.	117—122	...
110,950	Aug. 22	8	8	Ryde Ord.	140—150	...
270,086	Sept. 5	7	7	Slough Ord.	128—133	...
21,000	Dec. 19	5	5	Do. 5 p.c. Deb.	108—113*	...
28,872	Nov. 7	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	17/—19/–	—2/–
28,866	Sept. 5	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	17/—19/–	—1/–
117,228	Aug. 8	7	5	Swindon Cons.	102—107	...
60,425	Dec. 5	5	5	Do. 5 p.c. Deb.	110—115	...
64,380	Dec. 19	5	5	Torquay & Paignton 5 p.c. Pref.	105—110*	...
130,000	Aug. 8	8	5	Wakefield Ord.	116—121	...
81,650	,,	5	5	Do. 5 p.c. max.	100—105	...
82,000	Aug. 8	6	6	Weymouth Ord.	103—108	...
98,384	Aug. 22	6	6	Wolverhampton 6 p.c. Pref.	118—123	...
160,000	Dec. 19	5½	5½	Do. 5½ p.c. Rd. Db.	103—108*	...
90,000	Dec. 19	5	5	York 5 p.c. Red. Deb. ...	103—108*	...
133,640	July 18	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	118—123	...
120,000	,,	5	5	Do. 5 p.c. Pref.	105—110	...
35,000	Dec. 5	5½	5½	Do. 5½ p.c. Deb.	120—125	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 30.	Rise or Fall on Week.
347,756	July 18	6	5	Bath Cons.	117—119	...
1,667,250	July 18	5	5	Bristol, 5 p.c. max.	111—113	...
120,420	Dec. 19	4	4	Do. 1st 4 p.c. Deb. ...	98—101*	...
217,870	,,	4	4	Do. 2nd 4 p.c. Deb. ...	98—101*	...
328,790	,,	5	5	Do. 5 p.c. Deb.	117—120*	...
274,000	Aug. 8	5	5	Newport (Mon.) 5 p.c. max. ...	97—99	...
13,200	Sept. 19	8⅞	7	Pontyp'l Gas & W. 10 p.c. 'A'	12⅜—13⅜	...
13,600	,,	6	5	Do. 7 p.c. 'B' ...	11½—12½	...
40,000	,,	6	5	Do. 7 p.c. 'C' ...	11½—12½	...
140,778	Aug. 8	5	5	Weston-super-Mare Cons. ...	106—108	...
64,338	Dec. 19	4	4	Do. 4 p.c. Deb. ...	98—101*	...
33,340	,,	7⅛	7⅛	Do. 7⅛ p.c. Deb. ...	149—152*	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 30.	Rise or Fall on Week.
157,150	Aug. 8	6½	5	Chester 5 p.c. Ord.	109—111	...
92,500	Dec. 19	4	4	Do. 4 p.c. Pref.	95—99*	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	87—90*	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	97—101*	...
2,167,410	Aug. 22	6	6	Liverpool 5 p.c. Ord.	122—124	...
245,500	Dec. 19	5	5	Do. 5 p.c. Red. Pref. ...	100—105*	...
306,083	July 18	4	4	Do. 4 p.c. Deb.	100—102	...
106,280	Aug. 8	10	10	Preston 'A' 10 p.c.	198—208	...
188,219	,,	7	7	Do. 'B' 7 p.c.	131—141	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 30.	Rise or Fall on Week.
122,577	Aug. 8	8	8	Blyth 5 p.c. Ord.	160—162	...
732,000	Aug. 22	5	5	Hartlepool G. & W. Cn. & New	89½—90½	...
2,061,315	Aug. 8	5⅜	5	Newcastle & Gateshead Con.	22/9—23/3a	+–/3
682,856	,,	4	4	Do. 4 p.c. Pref. ...	100—101	+½
776,706	Dec. 19	3½	3½	Do. 3½ p.c. Deb. ...	87½—88½*	...
277,285	Oct. 24	5	5	Do. 5 p.c. Deb. '43 ...	103½—105½	...
332,351	Aug. 22	6	6	Sunderland 6 p.c. max. ...	135—137	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 30.	Rise or Fall on Week.
542,270	Aug. 8	9	6	Derby Con.	133—138	...
55,000	June 3	4	4	Do. 4 p.c. Deb.	100—105	...
20,000	June 20	5	5	Long Eaton 5 p.c. Pref. ...	10—12	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 30.	Rise or Fall on Week.
10,000	Aug. 8	10	10	Great Grimsby 'A' Ord. ...	205—215	...
6,500	,,	10	10	Do. 'B' Ord. ...	205—215	...
79,000	,,	10	10	Do. 'C' Ord. ...	195—205	...
1,806,339	Aug. 22	6½	6½	Sheffield Cons.	139—141	—1
95,000	Dec. 19	4	4	Do. 4 p.c. Deb.	100—102*	...

a The quotation is per £1 of Stock. * Ex div.

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